FLASHES AND PLUGS

SUCCESSFUL ADVERTISING. At Purdue University in Lafayette, Ind., males far outnumber coeds and there are times when getting a date is difficult.

One male student solved the problem recently by advertising in the campus paper:

"Any good-looking female wishing a date call 92-3177."

He received 10 telephone calls and wound up with a very pretty coed.

• • •

CAUTION BACKFIRES. When a Kansas City drug store employe got a telephone call to make a liquor delivery recently, he recalled that in the past such orders occasionally had resulted in holdups.

So he decided to make a preliminary investigation before delivering the liquor. He left his billfold in the store, picked up a .38 pistol and drove to the address given by the caller.

As he got out of the car, two men met him, relieved him of his keys, cigarette lighter, watch—and the pistol.

• • •

OPINION. The calm informative atmosphere at the Festus, (Mo.) exchange open house was shattered recently by a teen-age visitor among a group viewing the new dial equipment.

The youngster exclaimed to the division maintenance supervisor, "Dig that crazy pin ball machine!"—Southwestern Bell Telephone Co. *News.*

• • •

FORESIGHT. A jolly Milwaukee police captain, who often found humor as well as tragedy in some of the calls that came in at the old Number Four station, recorded this one in a "funny book" he kept:

A local mortician was told to "call for a body at 7:30 tonight."

"Why can't I call for it now?" the mortician enquired.

"I ain't dead yet," the man replied.

Police found him alive but pixilated.

• • •

THE PAYOFF. Workmen performing some neglected housekeeping recently in Philadelphia's City Hall, removed some 30-year-old telephone booths and came up with some treasures quite in keeping with the historic atmosphere. Discarded by telephone callers throughout the years were a dozen newspapers dating back to 1935, three bottles of what appeared to be Prohibition-type rum and a flag of the Philadelphia Sesquicentennial exposition held in 1926.

CIRCULATION

Guaranteed circulation of this issue is 10,095, of which 9,605 is paid.

Telephony

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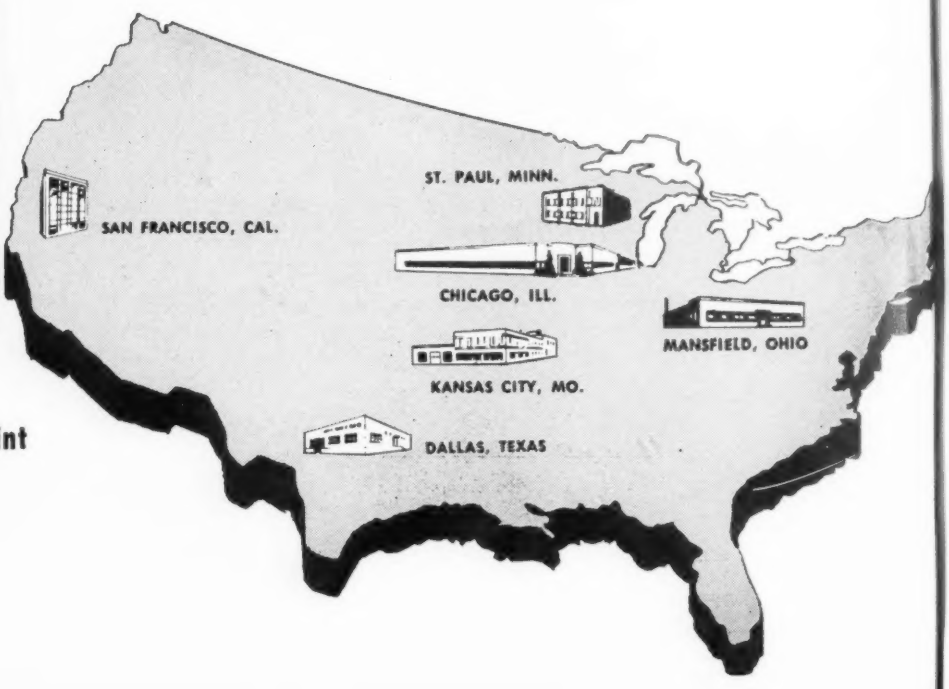

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★ ★ ★ IN THE ★ ★ ★ NATION'S CAPITAL

by FRANCIS X. WELCH WASHINGTON EDITOR

New York Telephone Co. rate increase denial a severe blow, especially when accompanied by continued downward trend in earnings. Absolute turndown seen as point on company's side, if it decides to appeal the case. Tax help ahead in matter of depreciation. Nation's economy flouting "prophets of doom."

THE DECISION of the New York Public Service Commission to deny, unanimously, the petition of the New York Telephone Co. for any rate increase whatever is unquestionably a blow to that company in its effort to raise additional revenues. Advance financial data already indicate that New York Telephone Co. earnings, per common share, probably will not cover dividends for the current year.

The company reported earlier this month the continuation of a downward profit trend. For the second quarter, earnings per share amounted to $2.02 as compared with $2.21 last year and $2.62 two years ago during corresponding quarters. During the first half of this year the company failed to earn its customary dividend by almost $750,000, as compared with the first half of last year, when earnings exceeded dividends by 2½ million dollars. All this points up the likelihood that a test case may be in the making—one that may prove important to public utility regulation generally.

It will be recalled that the New York Telephone Co. gave this rate increase petition everything it had in the way of case preparation and presentation. Arguments were made on the need for recognizing reproduction cost or current values in the rate base, particularly with respect to real estate. Financial experts, brought in by the company, testified that to maintain a strong credit position and attract investment needed by the company a rate of return of from 8 per cent to 9.66 per cent was necessary.

It is a well-known fact that the telephone companies have probably taken the brunt of the offensive, in this post-war inflationary period, to prove to regulatory commissions the need for a more realistic pricing of their services in the light of the steady deterioration of the purchasing power of the invested dollar. This has been primarily because the telephone industry has had comparatively more cases than other public utility lines and because the telephone industry is more immediately sensitive to inflationary trends than other public utility lines.

It was not a surprise to this observer that the New York commission, with its hidebound tradition of clinging to original cost depreciated as a basis for rate-fixing, should reject the company's efforts to change the regulatory policy in New York state. There were three surprising sidelights, however:

(1) The unanimity of the commission's decision. (2) The parsimonious rate of return allowed (5.91 per cent on net investment). (3) The labored reasoning of the commission's opinion in justifying its refusal to allow any rate relief whatever.

The company had asked for increases of 75 cents a month for most telephone service, $2.00 a month on business telephones, and higher charges on toll service and extra message calls above the monthly minimum. The company had asked for a rate increase of $68,850,000 (gross revenues).

The commission conceded that the company's present return of slightly under 6 per cent was below that found by commission and federal government experts as sufficient for company needs. But it was pointed out that the slight difference did not call for a statewide increase in rates to bring the company's earnings up to the indicated amount.

"It is not possible to fix rates with such a nicety," the commission said, observing that the company had been permitted to earn slightly more than 6 per cent in the past without a reduction being required.

In the light of the careful preparation of the company's case, the immediate reaction to the commission's decision will doubtlessly be one of discouragement for management. Keith S. McHugh, president of the New York company, said that it was bad news—not only for the company but for all telephone users as well. He pointed out that the company needs to earn more money in order to attract capital to provide more good service. In other words, the subscriber stands to lose, in the end, if the commission's order puts a blight on such growth.

But, looking at it another way, the very severity of the commission's refusal of any rate relief whatever, would seem to put the company in a better position for a court test, than if the commission had gone along part of the way and agreed to give a piece of the loaf by way of a partial rate increase. The total turndown—if the company takes this case to the New York state courts—should serve to focus the attention of the court on certain regulatory principles which the New York Telephone Co. claims are in need of reappraisal in the light of current conditions.

And so, while telephone companies, both Bell and Independent, throughout the nation may feel frustrated when regulatory commissions cling to traditional conventions despite persuasive evidence in favor of a "new look," we see signs that the reform seed is beginning to bear fruit. It has not been entirely a case of the industry beating its head against the regulatory wall all over the country.

The Matter of Depreciation

Take the problem of depreciation, complicated as it is by inflation. As applied to general industry, President Eisenhower, in recommending the adoption of the "declining balance method" for tax reductions, asked that it be incorporated in the Revenue Act of 1954. As finally adopted, the recent revenue law revision did liberalize the treatment of depreciation for tax purposes.

This was a most significant advance because the income tax has always been the real key to the depreciation problem. Regulatory commissions have always hesitated to loosen up on regulatory depreciation requirements as long as tax depreciation rules remain rigid—because it would simply mean the diversion of additional utility revenue into additional federal tax revenue. So, while the new law does not increase total depreciation allowances, it does accelerate accruals in earlier years, which can have somewhat the same effect as an increase.

Our state commissions have been moving slowly to give greater consideration to the question. The straight-line method of depreciation has at least the effect of getting the investor's dollars into the depreciation reserve before they become too much deteriorated by inflation. While the state commissions (with few exceptions) have remained deaf to the telephone industry's plea for "economic depreciation" accounting, the companies still have an incentive to keep hammering away in that direction. Partial compensation may well follow in due time, even though the goal is not fully reached.

Looking back over the last two or three years, much ground has been gained. But even more important in years to come, much seed has been planted and cultivated. The industry need not apologize nor discontinue its consistent effort to make intelligent arguments and keep rapping at the doors of regulatory commissions as long as it has a case to make.

Over the long pull, a number of state courts, if not their state commissions in the first instance, will surely perceive the need for more accurate assessment of the economic factors in these rate cases. They stand out more starkly with each new rise in the inflationary tide. The facts are there; the arguments are there; the evidence is there. It takes, in addition, perseverence and courage to breach the barrier of regulatory inertia.

The Missing Depression

Word that the American Federation of Labor had fired its national news broadcaster, Frank Edwards, for allegedly coloring his news broadcasts with personal opinions was one of the interesting recent developments in the field of communications. Edwards said he was fired because the AFL wanted him to slant his news broadcasts. This explanation may puzzle some listeners who might be under the impression that the broadcasts were already pretty well slanted.

Whatever the real difference may be, disinterested observers will probably best remember Mr. Edwards for (1) his rhapsodic approval of the cooperative and public ownership movement, particularly in the public utility field; (2) his dismal forecast that the present administration was bringing the country into an era of stark depression and unemployment, and (3) his tendency to give a blow-by-blow description of every report on flying saucers that came his way.

Mr. Edwards' devotion to the promotion of the federal government in the electric power business has, for some time, caused dismay in the ranks and leadership of that strong right bower of the AFL, the International Brotherhood of Electrical Workers. The official position of the IBEW has been quite the contrary. For that matter, so has been the position of the CIO Utility Workers Union. Both have expressed no desire to have their membership become employes of a nationalized or socialized utility industry.

But Edwards will probably be better remembered for his Jeremiah prophecies last winter about the "Eisenhower depression." Of course he had plenty of company in left-wing union leader circles. CIO President Walter Reuther, CIO Economic Adviser Robert Nathan, and even some of the AFL leaders seemed to be pretty sure that, by this time, the nation would be wallowing around in the depths of a depression, with huge armies of jobless tramping the streets of every major city. Even some of our political figures, such as Senator Douglas (D., Ill.), went for this bait and crawled out on the limb.

Now it seems to be the season for these pessimistic commentators to be getting back off the limb. They are doing this quite subtly—by boldly demanding to know why we are not now having a *boom!* Last week Walter Reuther denounced the President's Council of Economic Advisers because they are forecasting better things in the future.

The economic council of the AFL denounced Congress because it did not legislate an economic boom. And Leon Keyserling, former economic adviser to ex-President Truman and head of the new leftish Conference for Economic Progress, comes out with a scheme for more spending and less taxes as a panacea for permanent prosperity.

The truth of the matter seems to be that the labor and left-wing critics really have a valid point when they say that our economy is not so much booming, as coming out of a recession. But that is not the way they were talking six months ago. Employment has stayed about even between June and July, which is normally a quiet period when labor ranks are augmented by students seeking vacation jobs.

But the figures on rising income certainly belie the forecasts of the "prophets of gloom and doom" who were so busy with the black paint brush last winter. The annual rate of personal income was 284.4 billion dollars in April. By June it had gone up another 2 billion dollars, which was almost one billion dollars more than June a year ago. The same trend is seen in wages and salaries. In April the total disbursement was 194.3 billion dollars. It went up almost a billion more by June. This is still less than the comparable figure for June, 1953, by 4.7 billion dollars. And on this basis, left-wing economists are now refusing to take any comfort out of the present fairly full employment situation because, they point out, the figures show there is no boom!

The interesting point, in all this, is the program suggested by Mr. Keyserling for a permanent control of our national economy. It follows the familiar formula of vast federal spending for public works, meanwhile reducing taxes and letting the public debt skyrocket and letting the value of the dollar go to pot.

In a word, it would be an economy which is never stabilized. It would be an economy of printing press money without readjustment or corrective shakedowns, such as our system has just experienced during the past few months with only a few minor dislocations. Mr. Keyserling's idea is a perpetual inflation which would hide all maladjustment under a plaster of ever-cheapening money. It would be a situation which the Washington observer, Willard M. Kiplinger (paraphrasing former Vice President Henry Wallace's agricultural ideas about "ever-normal granary") refers to as an "ever-normal boomery."

Needless to say, public utility companies, with a heavy plant investment and rigid rate structures, particularly sensitive to continued inflationary trends, all would run into a ditch pretty swiftly if the nation's law makers ever go in seriously for permanent inflation as a deliberate policy of operating the nation's economy.

The dollar would rapidly travel down the same road as the old French franc (formerly 25 cents, now less than a third of a cent), the English pound (formerly $4.80, now $2.81), not to mention the utter collapse of the old German mark, Russian ruble, Chinese dollar, and other wallpaper currencies too numerous to mention. Operating a public utility, under the private enterprise system, would simply be impossible if such policies were ever adopted.

ABC of the Telephone

By FRANK E. LEE

PART 71—SECTION VIII. **Central office maintenance—how to read circuit drawings. The preceding article in this series appeared in the June 26 issue, page 20.**

UP TO THIS POINT, these articles on "how to read circuit drawings," have been concerned with the fundamentals of reading schematic drawings. This approach to the subject is quite logical because a primary objective of most maintenance people is both to understand the functions of circuits and to keep the circuit working properly.

The next logical step is to be able to understand how the various units of a circuit are put together. This requires the use of wiring diagrams, or in some cases, wiring charts. For ease of reference, the term "wiring diagram" or "wiring chart" will be used as appropriate in these articles.

A wiring diagram, in a way, can be compared with a blueprint of a house. A blueprint of a house shows all of the parts and details required to erect the building. It shows room sizes, location of windows, doors, plumbing, electrical fixtures, etc. In a similar manner, wiring diagrams show how the various relays, resistance units, and other pieces of apparatus are put together to make a circuit. The wiring diagram also shows how the apparatus terminals are wired together and the color of the wires used on each terminal.

The maintenance man probably will use a schematic drawing more often than he will use a wiring diagram. However, many occasions will arise when it will be necessary to refer to a wiring diagram while clearing a case of trouble in a given circuit. Wiring errors are few and far between. However they do occur and until they are corrected certain chronic cases of trouble never will be cleared. Sometimes a minor, intermittent case of trouble may be traced to a wiring error in equipment which was installed five or six years previously.

In other instances, reports of poor transmission are cleared when high resistance or resin solder connections are located and corrected. Wiring diagrams, generally, are used in conjunction with schematic drawings to locate these connections.

Direct Line Wiring Diagram

Originally, all wiring diagrams were of the direct line type. An individual line was used between terminating points for each wire in the circuit. This method of preparation is still in common use where small or simple circuits are involved. However, in larger, more complex circuits, so many lines are needed that most of the space on the drawing is used for an elaborate maze of horizontal and vertical lines. As a result, these drawings become cumbersome in size and are difficult to read.

The important factor involved in terminating any wire in a circuit is where to connect each end of the wire. For this reason, the most efficient type of drawing is one that will require the least amount of time to trace from one end of a wire to the other end. This should be true without regard to which end of the wire is the starting point.

If the requirements of an efficient wiring diagram are considered in the above light, it is apparent that the maze of interlaced lines should be eliminated from the drawings. Actually, the individual lines on a wiring diagram serve only as a path from one point to another.

Highway System of Wiring Diagrams

In the highway system of wiring diagrams, large heavy lines, called highways, are used to replace numerous individual lines between the various pieces of apparatus in the circuit. As will be noted on the typical drawing shown in *Fig. 1*, the highways extend both above and below the individual rows of apparatus units as well as between the various rows.

Feed lines, which are lighter than the highway lines, are extended a short distance from the apparatus terminal where they are merged into a highway. These feed lines represent the individual wires or leads used in the circuit. It will be noted that the feed lines approach the highway at a 90° angle, but merge into the highway at a 60° angle which indicates the direction that the lines travel over the highway.

The color of the wire represented by each feed line is shown on the drawing and each feed line is numbered as shown in *Fig. 2*, an enlarged section of *Fig. 1*. It is well to note that the number assigned to an individual feed line designates that feed line in only the particular highway involved.

For example, if a single wiring diagram has five highways, certain feed line numbers will be repeated five times on the drawing. However, a single number will be used to identify only one wire on any given highway. The use of this numbering system makes it possible to start at one end of a wire, to trace the wire over the feed line to the highway, and along the highway to its associated feed line without becoming confused with any other feed line on the diagram.

As a rule, the maximum capacity of a highway is 99 feed lines. However, in many instances, two or more highways with a total of less than 99 feed lines may be used in a single diagram.

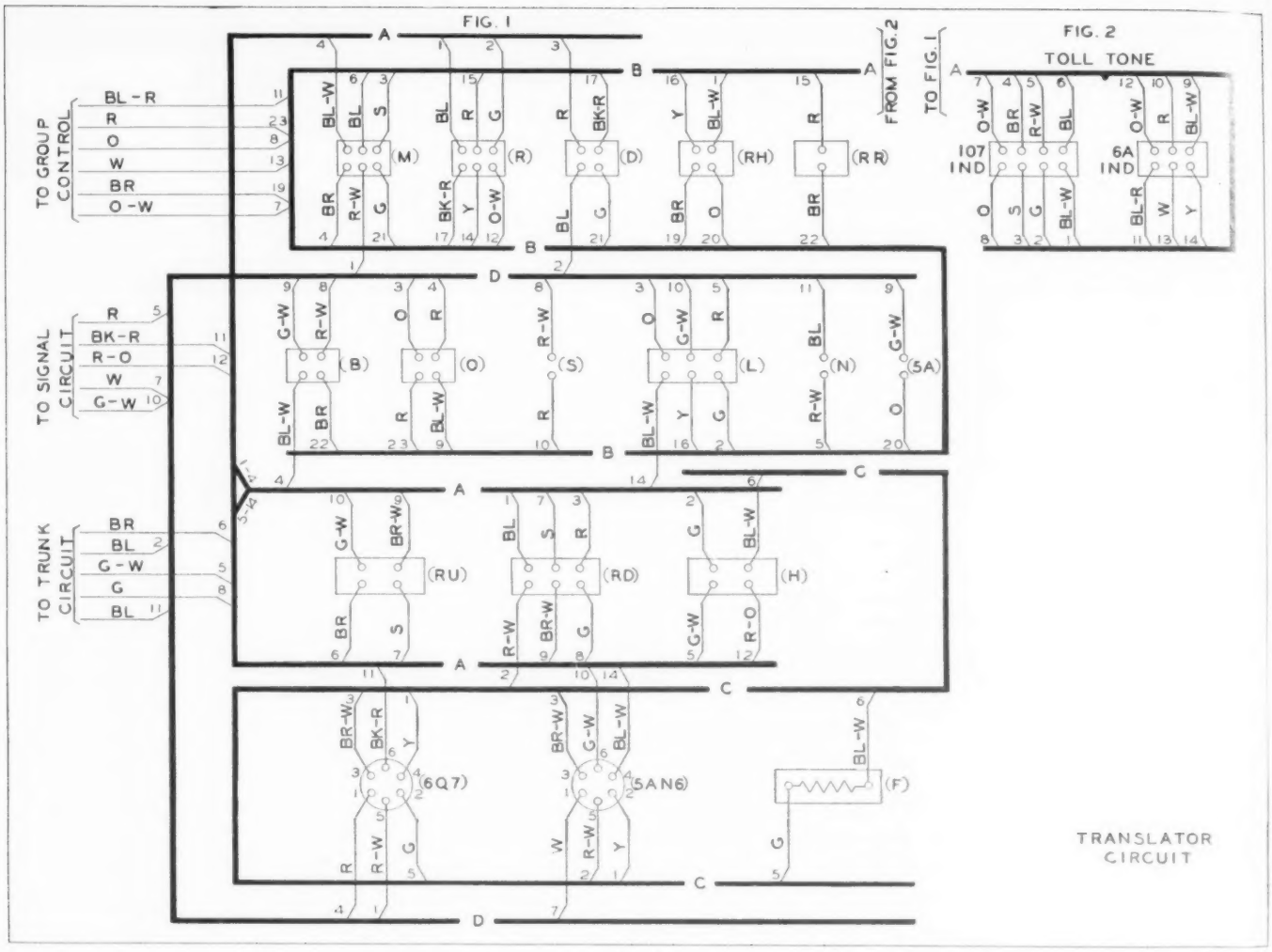

Fig. 1

The controlling factor in a case like this is the objective of simplifying the tracing of leads between the various apparatus units.

When a diagram has more than one highway, each highway is identified with a letter. This assists in tracing the highway as well as in preparation of the original drawing.

Some drawings include more than one figure or wiring option. If there is sufficient capacity in the highways, they can be used to interconnect the figures (see *Fig. 3*).

When a highway is used between two figures, the continuity of the highway is broken, the open ends are marked with a letter, and each end is bracketed. The ultimate destination of the highway is shown in the brackets. In this way the various figures can be placed in the most convenient position on the drawing without concern for the route the highways would follow between figures. Also, this procedure will facilitate the addition of figures to a corrected drawing.

When the capacity of the highways is insufficient to permit extending them between the figures on a drawing, separate highways, as required, and feed lines are used for the various figures, and the interconnection between the figures is made by feed lines that terminate at brackets. In this case the brackets are marked to show the figure to which the wires are extended.

This latter case is substantially the same method used to carry a circuit from one drawing to another as shown in *Fig. 4*. This system is used, because, generally, only a few of the wires represented by a highway are extended to the associated drawing. Thus, the individual wires are identified by color as they travel from one drawing to another.

As a result, each highway drawing becomes a separate unit with highway and feed line designations complete on the one drawing. The advantages of this system are apparent when one considers the confusion that would exist if a highway were extended across two or more drawings. If this were true, an

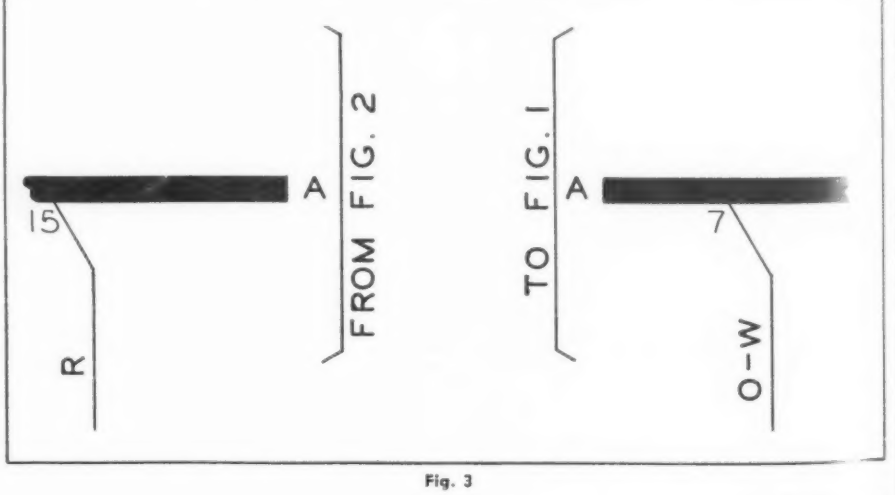

Fig. 3

elaborate highway cross reference system would have to be devised to properly designate the highways on all associated drawings.

Tracing Connections on Highway Drawings

The purpose of many of the details previously discussed can be demonstrated by tracing a few typical connections on the highway drawing shown in *Fig. 1.*

(1) *Connection originates and terminates on same apparatus mounting strip.*

A feed line marked G (Green) is connected to punching 2 of the 6Q7 tube shown in the lower left corner of *Fig. 1.* This feed line is designated as No. 5 at the point where it merges with highway C. The indicated direction of travel along highway C is left-to-right. A short distance to the right another feed line designated No. 5 emerges from highway C. This feed line also is marked G and it is terminated on the left punching of resistor (F).

(2) *Connection originates on one apparatus mounting strip and terminates on another.*

A feed line R (Red) is connected to the upper right punching of relay (RD) which is located in the center of the mounting strip second from the bottom. This feed line is designated as No. 3 at the point where it merges with highway A. The indicated direction is right to left along highway A. Moving to the left a junction is encountered. As shown at the junction point, feed lines 1-4 travel upward and feed lines 5-14 travel downward.

Therefore, travel upward from the junction point to the top of the drawing and over to the right. Near the end of highway A feed line No. 3, marked R, emerges and is terminated on the upper left hand punching of relay (D).

(3) *Connection originates on one figure and terminates on another figure on the same drawing.*

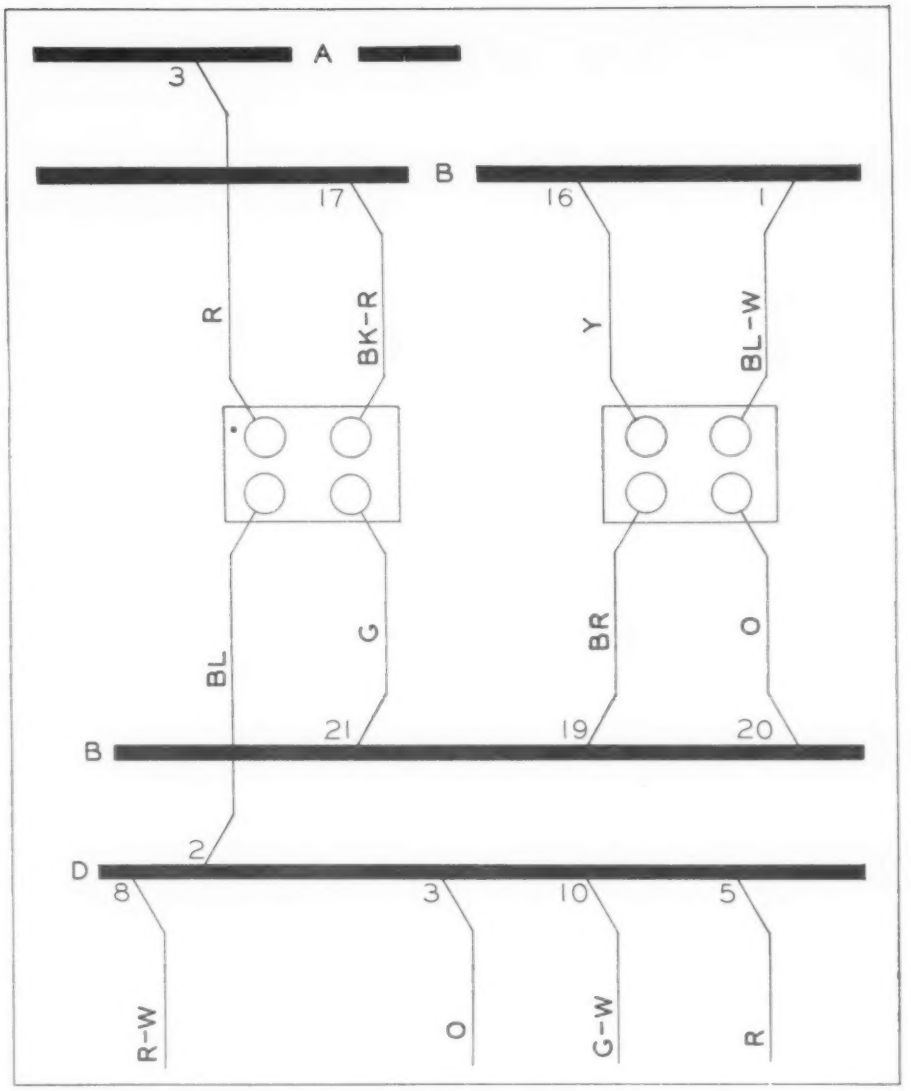

Fig. 2

A feed line marked Y (Yellow) is terminated on the lower center punching of relay (R) which is located on the top apparatus mounting strip. This feed line is designated as No. 14 at the point where it merges with highway B. The indicated direction of travel is right to left. At the left of the drawing highway B turns up, then to the right, along the top of the drawing.

Highway B is broken at a bracket near the edge of the larger portion of the drawing which is known as *Fig. 1.* The letter "A" has been arbitrarily assigned to the highway at the point where it is broken.

The bracket is labeled "From *Fig. 2.*" This means the highway will continue at point A in *Fig. 2* where another bracket, labeled "To *Fig. 1*" will be found. Continuing to the right, highway B turns down the drawing then to the left where feed line 14, marked Y, emerges and terminates on the lower right contact on inductor 6A.

If *Fig. 2* were larger and two or more highways were extended between the two figures, the necessity of marking the broken ends of highway B with a small letter A would be more apparent.

For example, if highway C were extended into a larger *Fig. 2* it would be broken and bracketed similar to highway B. However, the broken ends of highway C would be designated with a small letter B.

The letter assigned to label a broken

(Please turn to page 32)

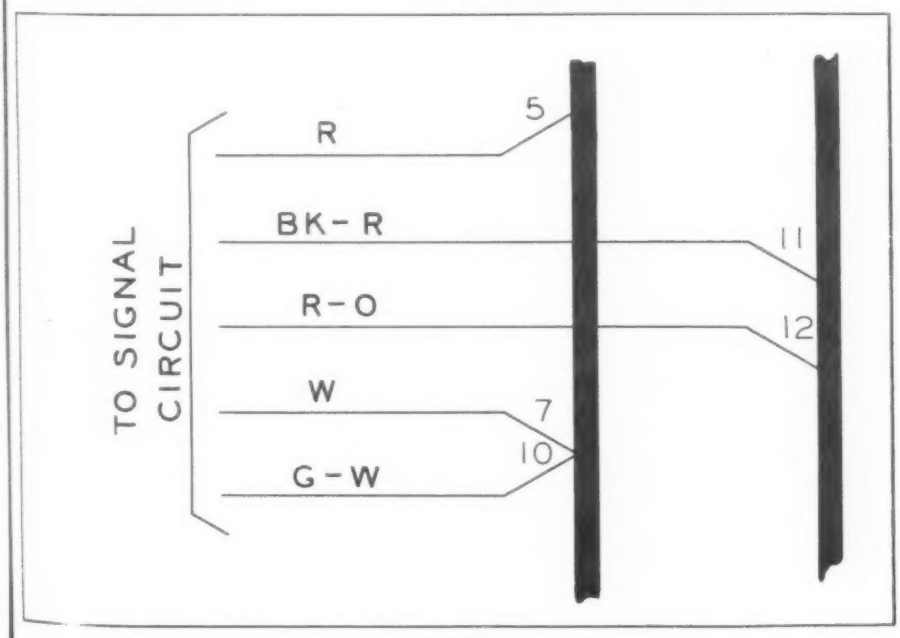

Fig. 4

CARRIER SYSTEMS

By HAROLD B. McKAY

Part 5

THE FOREGOING articles in this series explained basic carrier equipment and illustrated the main working parts of a simple three-channel system.

This chapter explores some of the added circuit refinements which are found on carrier systems with a greater number of channels, though some of the devices are available as accessories to smaller systems. Inasmuch as most of the complications of a carrier system develop because of the wire line, this chapter discusses the line first. The characteristics of the line which cause the problems in carrier are outlined; then the basic theory of some of the corrective devices is explained.

Following this, the operation of regulators, compressors and expandors is developed from the theory brought about in the explanations mentioned above.

Transmission Lines

Vacuum tubes, coils, condensers and other carrier equipment components can be built to a high degree of accuracy and stability, but the wire line over which the system will be used is a variable factor.

Any wire line, cable pair, coaxial conductor or antenna lead-in is a transmission line. Its function is to carry electrical energy from one point to another. Simple though its construction, the line is extremely important electrically and a regular science of "transmission line theory" exists which explains its action.

This importance is not apparent in voice frequency local telephone lines which may work fairly well with haywire construction but, as frequency increases, the nature of the transmission line has a profound effect on the circuit.

Every electrical conductor has some inductance, even though it is stretched between poles instead of wound into a coil. There is no place in the universe where a conductor could be placed where it would not act as one plate of a condenser in relation to some other object somewhere. A pair of telephone wires have a capacity effect with each other and other wires and to ground. The familiar capacity "kick" noted on the meters of testboards when a pair is tested is evidence that the line is also a condenser.

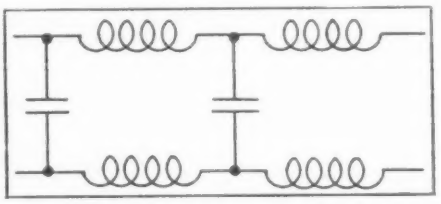

Fig. 15. - Any pair of wires is electrically equivalent to a number of condensers and coils, connected as shown. Thus any transmission line will have an effect upon high frequency carrier currents, beyond the mere resistance effects of the actual wire.

When the natural inductive effect is combined with this condenser action, a pair of wires can be seen to be the equivalent of a large number of coils connected in series, with a large number of condensers shunted across them. It is important that this concept is borne in mind in analyzing the action of a transmission line. (See *Fig. 15.*)

If the line then is really the same as a number of coils and condensers, when a current is applied to it the "coils" will retard it, while the "condensers" retard the voltage. In addition, the natural resistance of the wire will also reduce the current. In any electrical circuit the combined effects of inductive reactance, capacitive reactance and resistance is called impedance. Because each of the components is measured in ohms, impedance is also measured in ohms.

Note, however, that the effect of the condensers and the coils change as the frequency changes (as explained in Part 2), while the effect of the resistance of the line is the same at all frequencies.

An additional factor is present when high frequency is used on a line. This is called the "skin effect." This means that the higher a frequency is raised, the more the current tends to flow on the outside of the wire, rather than in the center. Because the conductivity of the outer "skin" of the wire is the only resistance that counts, high frequency carrier systems often use copper-clad steel line wires. For the same reason, galvanized steel wire cannot be used, because the high resistance of the zinc coating is too much for satisfactory operation.

From the foregoing general facts, the "characteristic impedance" of a transmission line results. Open wire lines, cable pairs, coaxial cables and television lead-in wires each have a char-

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Reprints of the completed series on "Carrier Systems" will be available following its publication in TELEPHONY (last installment to appear in the Sept. 18 issue), *providing sufficient orders are received to justify reprinting.* Companies desiring reprints for their employes are asked to inform TELEPHONY the quantity they will need as early as possible.

acteristic impedance. The impedance is given in ohms, such as 75-ohm coax, 600-ohm line, 135-ohm cable pair, etc. This figure in ohms does not represent the actual resistance of the conductors. In fact, a 300-ohm piece of television lead-in wire is 300 ohms if it is a foot or a mile long.

This figure in ohms represents the load an infinitely long piece of the line would present to a source of power. The behavior of electricity is such that when voltage is connected to one end of a wire, current will flow until it reaches the other end. Thus current actually flows in an open circuit, at least for a fraction of a second. This current flow causes the "capacity kick" referred to previously.

But at what rate does the current flow on an open line? It flows at a rate determined by the characteristic impedance of that line. Thus, a 600-ohm wire line open at the far end, supplied with a given voltage, would pass the same amperage as a 600-ohm resistor would, until the current reached the open end.

The characteristic impedance of a line (also called "surge impedance") is determined by the size of the wires, the spacing between them and the *material between them*. Thus insulated wire, or wire with a heavy ice loading, would have a different impedance than bare wires of the same size and spacing, because the insulation or ice would constitute a different material than air between the wires. As will be shown later in this chapter, ice, water or other changing conditions on a wire line bearing carrier current can affect the performance of the circuit.

Tables for calculating transmission line impedances can be found in radio handbooks by those who would pursue the matter further.

Impedance Matching

It was mentioned above that a 600-ohm line would pass current at the same rate as a 600-ohm resistor would. This would apply until the open in the circuit was reached, then the current would stop. However, if a 600-ohm resistor were connected *across* the 600-ohm line, current would continue to flow. Under these circumstances the line would be said to be terminated in its characteristic impedance. Electrically, then, this 600-ohm line with the resistor would appear the same to a power source as a 600-ohm line of infinite length, without a resistor.

This is more than an academic novelty, for if the line is terminated in a resistance which is the same as the line's impedance, perfect transfer of energy results. That is, all of the power sent down the line ends up in the resistor, and the line is said to be matched. By the same reasoning, if the power source (battery or transformer) also had an internal resistance of 600 ohms, then maximum efficiency would result.

In this case, the 600-ohm transformer would match perfectly to the 600-ohm line. Optimum transfer of energy would result; the line would take the full output of the power source and deliver it to the resistance. If any part of this system were not of the same impedance, a so-called mismatch would result, with various undesirable effects.

One of the things that happens in a mismatch is "reflections." When current travels down a wire which is open at the far end, it travels until it reaches the end. This builds up a charge at the end which then causes the direction of the current to reverse and go back to the source. This is a reflection and represents energy that was generated but not delivered to a load.

If we have a 600-ohm line terminated in a resistor of, say, 400 ohms, part of the transmitted current will be used in the resistor, but part will be reflected back, just as though the line were open. This is of great importance in alternating current circuits, where this may be happening thousands of times per second.

In order to get a good concept of impedance matching, there is another way of thinking about this. Impedance measurements are used in radio and carrier work, rather than voltage and amperage. The electric lights in your house are talked about in terms of volts and amperes, yet in both cases, the problem is delivering power from a generator to a load.

In the electric light circuit, the voltage is always the same; so is the frequency. In radio and carrier, both voltage and frequency fluctuate up and down with the speaker's voice; therefore, repeat coils, transformers and other parts cannot be rated by voltage or frequency, because these are never constant.

Yet impedance matching, to stretch a point, is much the same as the matter of putting a lamp of the correct voltage on a given circuit. You use a 110-volt lamp on a 110-volt line and in carrier you use a 600-ohm transformer on a 600-ohm line. The impedance is used for the figure rather than the voltage.

One further point should be noted: We are talking about alternating current circuits, and as the frequency changes on such a circuit, the response of condensers and coils change also. Therefore, impedance values of electronic components are usually given for some arbitrary or nominal frequency. The value will be different for other frequencies. For instance, a 600-ohm repeat coil which is rated at 1,000 cycles will have a higher or lower impedance at other frequencies.

This is satisfactory for telephone purposes, however, and the rated frequency in many circuits is a design center; that is, the actual frequencies used will vary above and below the rated frequency. However, the further the frequency changes, the greater becomes the mismatch and transmission falls off. This is one of the reasons every communications circuit, from a magneto set to a "hi-fi" phonograph has a limit somewhere as to the band of frequencies it will transmit.

Slope

The transmission, or wire line, in a carrier circuit, because of the conditions noted above, can cause a number of difficulties. Because the line is electrically the same as a bunch of coils and condensers, it will have a retarding effect as the carrier frequency is increased. If a graph chart were made showing how the loss on the line increases with higher carrier frequencies, the line would be in the form of a slope.

Hence, this condition is often referred to as the slope, and devices for offsetting the effect may be called slope correcting devices. In one form this may consist of a filter, which has a response to frequency which is opposite to that of the cable pair, so that one effect cancels out the other. This filter could be installed in the receiving end of the system, and would act to cut down the power of the lower frequency channels, while the line itself would be cutting down the higher frequencies, thus presumably making all of them come out about the same. These corrective filters are called equalizers.

Bulge

The slope, then, results from the fact that the line cuts down the higher frequencies more than the lower frequencies. However, the "slope" may not always be a straight line. As the temperature of the line changes, its response to different frequencies changes, but not in a regular manner. This would cause the slope line on a graph chart to show a "bulge," which gives us the name of another condition which must be corrected on a carrier line. Because this changed transmission condition can affect different channels to different degrees at different temperatures, the effect is known as "twist."

Wet or Dry

Open wire lines, in addition to tem-

perature effects are also subject to weather conditions, and the impedance, and hence the response of the line varies depending on whether it is dry, wet or ice loaded. These conditions must also be compensated for by appropriate corrective devices.

Noise and Cross-Talk

Besides all of the foregoing, the wire line is also a source of noise and possible cross-talk, and these effects are variable depending upon a number of different factors. From a standpoint of practical carrier maintenance, it is sufficient to know that all of these conditions may exist, rather than the technical reasons therefor.

Regulation

Successful carrier operation has resulted from the design of equipment which offsets the complications mentioned above. Each particular difficulty with the transmission line has been met with a corrective device. It was mentioned that the slope of the line under given conditions could be offset by a suitable equalizer of fixed components.

However, the other difficulties encountered are of a variable nature. The twist, the bulge and the over-all loss of the line may vary from time to time. Weather changes, noises come and go, temperature rises and falls. It is, therefore, necessary to provide devices which are variable in nature, which can constantly change to offset the changing line conditions.

Pilot Regulators

If you were listening to a far-off station on your radio, which kept fading off and on, you could probably get reception by constantly twisting the volume control. In a carrier, a device can be placed which will in effect monitor the strength of the carrier, and adjust the amplifiers up or down to keep the output volume reasonably constant.

This is called a pilot regulator. It does not monitor the voices on the system, which change in volume, but may have a separate frequency transmitted just for that purpose. This pilot frequency can be a tone that is sent in a separate narrow carrier channel located half-way between the highest and the lowest channels. In some systems, which use frequency shift signalling, as described earlier in these articles, the signal frequencies can be used for pilot regulation because one or the other is always present. That is, if the frequency shifts from 3,500 to 3,700 cycles when the trunk is seized, the 3,500 can be used for regulation, because it will be on during the conversation, and the 3,700 can be used when the trunk is idle.

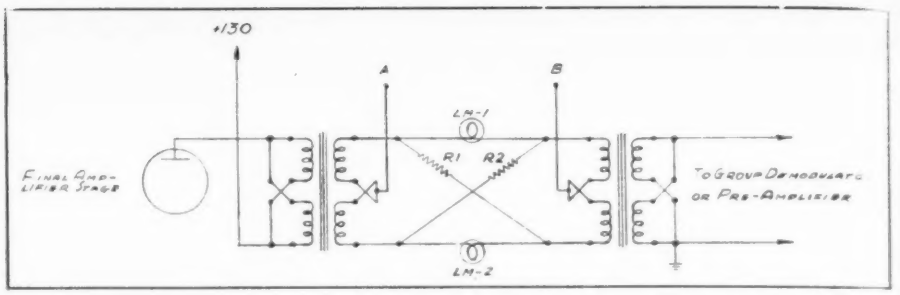


Fig. 16. This carrier regulator uses two tungsten lamps in a bridge circuit. When direct current which varies with the carrier strength is applied to points A and B, the resistance of the lamps varies also. This changing resistance regulates the amount of carrier that gets through from the final amplifier to the demodulator. (Drawing courtesy of Lynch Carrier Systems, Inc.)

Note that it is possible to provide separate regulation on each channel in this manner. This has a distinct advantage in high frequency systems with a large number of channels.

A pilot regulator which monitors a center frequency in the carrier band provides a regulation which is presumably the average of the different channels. It operates by rectifying the incoming pilot signal, and applying the voltage to an automatic volume control circuit. One such system consists of sensitive relays which alternately operate as the strength of the incoming carrier rises and falls. These relays control the operation of a small electric clock motor, which slowly cuts in or cuts out a loss network to compensate for the changes.

A single frequency pilot, as described, actually does not fully compensate for bulge and twist, because the different channel frequencies behave erratically under different temperature conditions. Some systems, therefore, use several pilot frequencies at different parts of the carrier band, each connected to appropriate regulating amplifiers and other equipment.

In addition to the motor-controlled loss network mentioned, other devices exist for causing the pilot signal to change the gain of the carrier amplifiers and thus compensate for line changes.

One such system uses a bridge network at the output of the receiving amplifier at a point where the carrier would otherwise be fed directly into the demodulator. This bridge consists of two fixed resistors and two tungsten lamps. The lamps act as variable resistors because the resistance of the filament changes with its temperature.

In operation, the pilot frequency is rectified into a dc current which will change as the strength of the carrier varies with the line conditions. This varying dc voltage is applied to the filaments of the lamps, causing their resistance to vary. The bridge circuit is accordingly unbalanced and the amount of loss it introduces into the circuit varies. When the carrier pilot signal weakens, the bridge decreases its loss, permitting more of the carrier to get through to the demodulator, thus offsetting the line loss. (See *Fig. 16.*)

Another method involves the use of thermistors. These devices are variable resistance elements whose resistance lowers as the current flow through them increases. In this effect they behave oppositely to the way the tungsten lamps do.

A thermistor is placed across the line at a point where some of the incoming carrier current will pass through it, raising its temperature slightly. This rise in temperature causes its resistance to lower and hence pass more current.

This effect can be used in different ways to control the net amount of carrier entering the channel units. In some systems, the line or group amplifier (which amplifies all channels) has a feedback circuit. In our description of oscillators, it was explained how a portion of the output voltage of a vacuum tube could be fed back into the input of the tube, and thus make it self-regulating. That is, if the output voltage fed back was of an opposite polarity to the input, it would tend to cancel out and reduce the amplification.

In a feedback amplifier as used in a carrier group receiver, the amount of this fed-back voltage can be controlled by a thermistor. Therefore, as the received carrier strength fades with line conditions, the thermistor can be made to change the feedback voltage and cause the amplifier to boost the signal more, thus making up for the fading.

In order that the thermistor shall not be affected by the temperature of the room in which the equipment is located, the thermistor may be artificially heated by a tiny filament, to keep it well above room temperature. Frequently another thermistor to monitor room temperature is also included in the circuit.

From the above it can be seen that

(Please turn to page 34)

THE PLANT MAN'S Notebook

by Ray Blain, Technical Editor

WE TALKED to an engineer recently who advocates the use of plastic insulation on one or both wires of long span open wire rural lines. He contends that with this arrangement, the wire may be left slack so that the strain will be reduced and there will not be any trouble due to hits.

Moreover, he says that wires striking together will not cause any trouble to the modern plastic insulation. He plans to make use of 080 Copperweld and high-tensile steel wire in these experiments.

His plans also contemplate an experiment of tying two of these insulated wires on one double groove glass insulator. If this arrangement proves successful, then one four-pin crossarm will carry four rural lines without being overloaded.

It would seem that such an arrangement has possibilities of providing good though inexpensive construction which will furnish reliable rural telephone service.

• • •

The General Telephone Co. of Kentucky *News* recently carried a page picture of the three little monkeys so well known as See Not, Talk Not and Hear Not. The new version used by the General company is titled "Three Causes of Accidents," and the monkeys' names have been changed to: I Didn't Look, I Didn't Ask and I Didn't Listen.

In our opinion, this makes a most effective safety poster.

• • •

It has been said that it costs less to do it right than to do it over.

• • •

The *Transmitter* of Chesapeake & Potomac Telephone Co. of Washington, D. C., recently carried a story titled: "New Overhead Ladder Racks on Washington Trucks Provide Added Safety." This article states in part as follows:

"The skillful, exacting work of telephone craftsmen must frequently be performed on ladders. When proper safety practices are followed, all goes well; when they are violated, there sometimes is a serious accident.

"Most ladder accidents come from falls. Yet lifting and carrying them offer certain hazards, too. Here again these are usually due to lack of familiarity, or disregard for, safety precautions.

"Continuing studies are made to improve the design and operation of our equipment. One example of progressive improvement is the method of carrying ladders on light installation trucks. At first, they were carried on racks on the left side. This partially obscured the driver's vision, and subjected him to traffic hazards while placing or removing the ladder. And it was recognized that, under certain emergencies, the driver might be trapped in the cab.

"So the overhead rack became standard on 85 per cent of the light installation trucks in the Washington company. The remaining trucks with side racks are being replaced through obsolescence."

Several years ago when the overhead ladder rack made its appearance in the Independent telephone industry, this writer voiced approval and predicted that it would eventually replace the dangerous side-mounted type.

Numerous critical letters were received at that time from readers who contended that the side-mounted ladder was perfectly safe and much more convenient than the top-mounted variety. It is true that most people are always critical of and slow to adopt new things, but it is also true that good ideas always win out eventually.

• • •

Safe ladders for telephone work have always been a problem. Broken ladders have been the cause of many serious accidents. Metal ladders made of magnesium or aluminum, although lightweight and strong, have not been generally accepted in the utility field because they present an electrical hazard. In order to provide the required electrical safety, practically all of our ladders are made of wood.

However, wood does not make a perfect ladder as it is subject to weakness due to decay. Often the weakness in ladders is hidden. Seldom are ladders painted because the paint may hide dangerous defects caused by wood decay. This decay usually occurs in the ends of the hardwood rungs where they are tenoned into the softwood side rails.

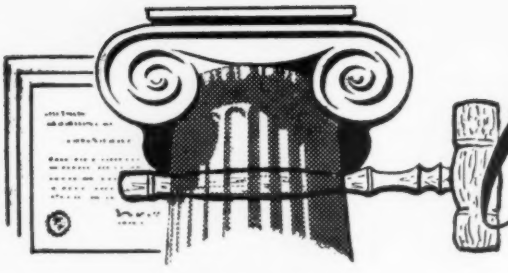
The Bell System has adopted a plan of attacking this decay problem in rungs by dipping them in a pentachlorophenol-mineral spirits solution prior to ladder assembly. A 5 per cent concentration of pentachlorophenol in a petroleum base is used for this purpose. This solution also contains a water-repellent material that further minimizes the danger of fungi infection.

We are of the opinion that in the not-far-distant future it may be possible to insulate metal ladders by treating them with some plastic material. It would appear that liquid neoprene might be satisfactorily used for this purpose.

It is understood that the Germans now have a liquid linoleum that is merely painted on floors and which resists wear for years. If a metallic ladder could be insulated in this manner, it would certainly be welcomed in the communications industry and by safety people everywhere.

• • •

It has been said that if the boss hands you a tough job, he isn't picking on you. He's complimenting you. Batting practice pitchers aren't selected to hurl the first game of the World Series.



Courts and Commissions

Grant Rate Raises to Three Minnesota Independents

Three Independents were authorized by the Minnesota Railroad & Warehouse Commission on Aug. 6 to raise rates. They are the Citizens Telephone Co., Maynard; the Lakedale Telephone Co., Annandale, and the Wykoff Rural Telephone Co.

Approved rates for the Citizens company will increase operating revenues from $11,058 to $12,881, and net income from $386 to $1,279. The new net is a 5.72 per cent return on a plant original cost of $22,347. Old and new rate schedules of the Citizens company are:

	Old	*New*
One-party business	$3.00*	$4.25*
Two-party business	—	3.75
Rural multi-party business	—	3.75
One-party residence	1.75*	2.50*
Two-party residence	1.50	2.00
Four-party residence	1.25	1.50
Rural multiparty residence	2.50	3.00
Switching station	.60	.90†

*Optional: An additional charge of 50 cents per month for common battery service.

†Minimum charge of $4.50 per month per circuit, for switching line.

In addition to the above rates, 25 cents per month additional for handset instrument to a subscriber receiving magneto service.

The Citizens company serves 186 local, two rural and 245 switched stations.

New rates for the Lakedale company and its eight exchanges were calculated to give a 5.15 per cent return on a plant original cost of $378,900. Operating revenues are to be $106,951 (previously $98,370) and net income $19,518 (previously $16,701). Approximately 974 local, 1,037 rural and 48 switched stations are served by the Lakedale company. The new rate schedule is as follows:

One-party business	$5.00
Two-party business	4.50
Rural multi-party business	3.50
One-party residence	3.25
Four-party residence	2.50
Rural multi-party residence	3.25
Switched station	.75*

*Minimum charge of $3.75 per month, per switched circuit.

The Wykoff company's approved rates are expected to produce new operating revenues of $6,072—up from $5,175—and turn a deficit of $838 into net income of $101. This net is a 3.18 per cent return on a plant original cost of $3,180. The company serves approximately 136 local and 163 switched stations.

V V

Pa. Commission OK's Sale of Independent to Commonwealth

Commonwealth Telephone Co., Dallas, has been authorized to buy the Pennsylvania Community Telephone Co., Bangor, by the Pennsylvania Public Utility Commission, it was reported on Aug. 11 (TELEPHONY, July 24, p. 38).

Commonwealth will buy from Pennsylvania Community's parent company, Inland Telephone Co., Wilmington, Del., 42,500 shares of common stock. In addition it will purchase $590,500 worth of notes.

Pennsylvania Community serves 12,750 subscribers in six counties. Commonwealth said it plans to spend $750,000 to modernize the Pennsylvania Community system.

Commonwealth serves 30,200 subscribers in nine counties.

V V

Pacific T&T Asks Second Rate Increase for California

Another increase in California telephone rates, to yield an additional $7,071,000 a year, was asked by the Pacific Telephone & Telegraph Co. in an application filed on Aug. 5 with the California Public Utilities Commission. The company said it needs the extra funds to meet the expected expense which will confront it next year under the new federal corporate income tax act.

A rate increase of $11,100,000 a year has already been put into effect by the company on Aug. 1, under permission granted by the commission. In granting this amount, which was about one-fifth of the sum requested, the commission judged it to be "fair and reasonable," representing a rate of return amounting to 6.25 per cent a year on investment. The decision stated, however, that if Congress increased corporate tax rates, an upward adjustment in rates would be made. The new request for rate increase is in accord with this decision.

V V

Adopt Minimum Standards for Ohio Telephone Companies

Ohio's telephone industry, composed of more than 175 companies comes under a set of minimum service standards next Jan. 1. (These approved standards were given in TELEPHONY, July 24, p. 35.)

The Ohio Public Utilities Commission adopted the standards on Aug. 9. There was a public hearing on them on Aug. 2 at which time most telephone companies approved the suggested rules and regulations.

Representatives of several companies asked that they not be put into effect until the first of next year, and the commission followed that recommendation.

The rules mean that for the first time Ohio will have a yardstick to measure "adequate" telephone service. One rule states that every company should provide 24-hour-a-day service. Some don't now.

Some of the rules go into effect next Jan. 1, others next July 1 and still others on July 1, 1956.

The standards cover such things as adequate facilities, delayed calls, maintenance and repair, improved transmission, trouble reports, service interruptions and service applications.

The rules will help the commission handle service complaints, Commissioner Ralph Winter said. He has been working closely with telephone companies on service problems during the past several months.

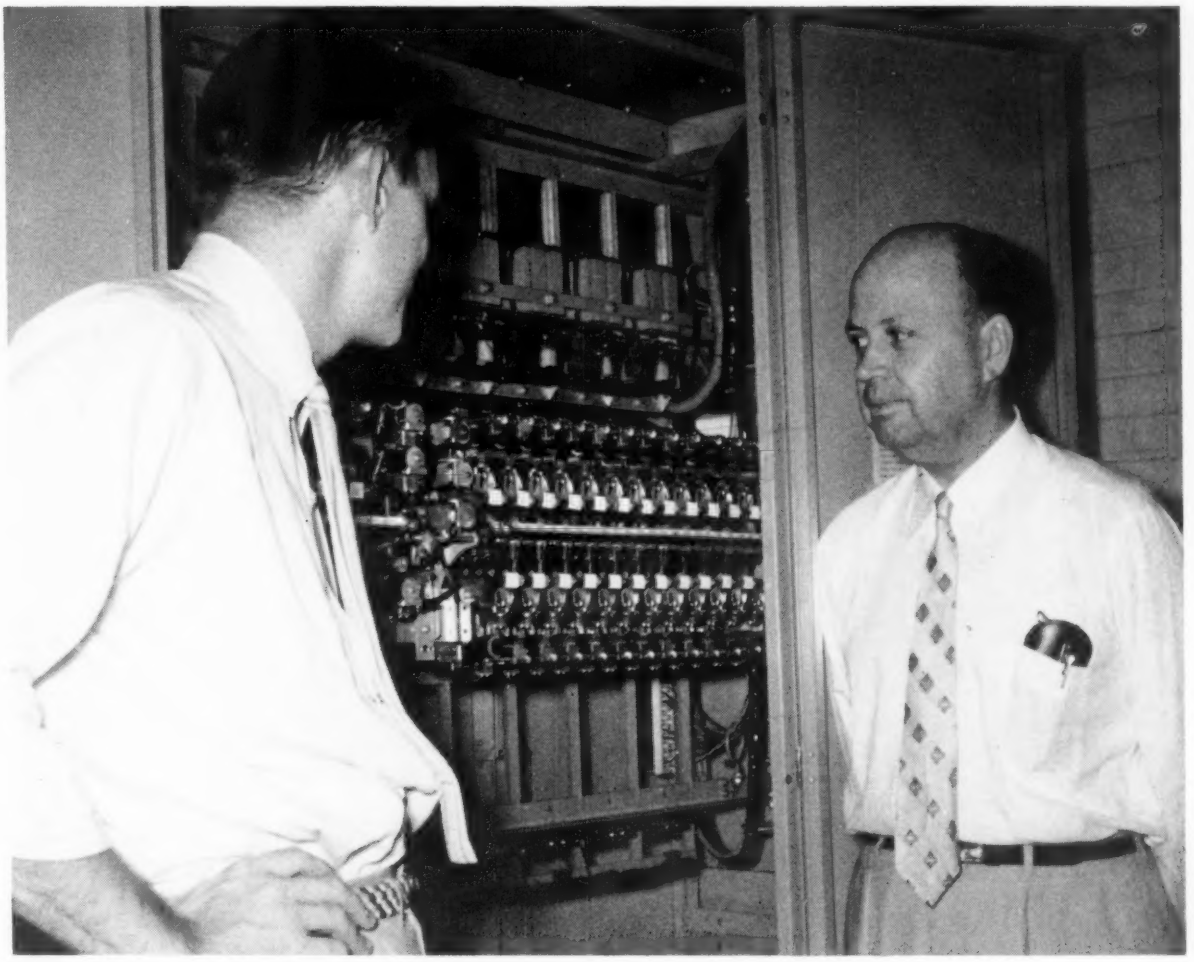
V V

S. C. Company Subscribers Protest Operation by Co-op

A rather unusual situation has arisen in regard to the purchase of the property of the Coastal Telephone Co., Loris, by the Horry Telephone Cooperative, an REA-financed co-op, which is now before the South Carolina Public Service Commission, it has

(Please turn to page 30)

hey're making P-A-B-X pay!



L. A. Corning III (left), Tarboro Sales Supervisor, Carolina Telephone and Telegraph Company, chats with Dr. Theo. Easom, a P-A-B-X subscriber, during a routine checkup call. Prospects are invited to visit existing installations such as this. "On such occasions," Mr. Corning says, "our P-A-B-X users tend to be our best sales boosters."

Mr. Corning regularly scans the local newspapers, notes new industries, and then contacts them. If the sale is not completed during the initial interview, a follow-up sales letter is sent "to verify monthly charges and contractual requirements." Says Mr. Corning: "We have found this letter particularly effective."

Inquiries for P-A-B-X service draw a quick personal visit.

Carolina Telephone and Telegraph Company operates 110 exchanges and 186 P-A-B-X's.

Follow the lead of these progressive telephone men. Start promoting P-A-B-X today. Ask for our helpful sales kit and *quick delivery schedules* on stock P-A-B-X switchboards!

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Originators and Developers of the Strowger Step-by-Step "Director" for Register-Sender-Translator Operation . . . Machine Switching Automatic Dial Systems

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been reported (TELEPHONY, Aug. 14, p. 44).

The commission reduced the service area of the coastal company, assigning all rural area in the Loris vicinity to the cooperative. The Coastal company then sold its properties to the cooperative which included it in its program of furnishing rural service throughout Horry County, S. C., with funds advanced by REA.

It was reported that when application was made to the commission to transfer the ownership of the property, the subscribers of the Coastal company, together with the town officials, appeared before the commission and strenuously objected to being required to subscribe to the stock of the cooperative in the original amount of $50 although this requirement was later reduced to $22.

The Coastal company subscribers reportedly contended that they were already receiving service from the present company and saw no advantages to be gained from cooperative membership as they were now receiving dial service without the purchase of memberships and also at a lower monthly rate than that proposed by the cooperative.

The Loris city officials contended that the membership requirement would be detrimental to the business interests of the community, particularly in the location of new enterprises in that locality.

The South Carolina Public Service Commission is reported to be considering the complaint and is expected to make a decision in the matter within a short time.

V V

Western L&T Gains Increases For Oklahoma Exchanges

Western Light & Telephone Corp., Inc., Great Bend, Kan., was granted higher intrastate rates at its exchanges in Oklahoma by the Oklahoma Corporation Commission on July 30.

The new rates are estimated to yield a return of 6 per cent on the company's properties in Oklahoma and are:

	A: 1,400 to 2,099 stations	*B: 700 to 1,399 stations*		*C: 1 to 699 stations*
	Common Battery	*Common Battery*	*Magneto*	*Magneto*
One-party business	$6.25	$5.75	$5.50	$4.50
One-party residence	3.35	3.15	3.00	2.75
Two-party residence	3.10	2.90	2.75	2.50
Four-party residence	1.50	1.50	1.50	1.50
Rural metallic	2.75	2.75	2.75	2.75

(Above station rates cover wall and desk equipment only; handsets, 25 cents extra.)

Shown making the first call over the new automatic system in the Carey, O., exchange of the Northern Ohio Telephone Co., Bellevue, is Mayor G. C. WAGNER. Next to the mayor is Col. W. C. HENRY, president and general manager of the company, one of a group of 36 company representatives and invited guests attending the cut-over. The Northern Ohio company purchased the Carey Electric Telephone Co. in 1948. Today 56 of the Northern Ohio company's 66 exchanges are automatic. More than 92 per cent of the 86,000 telephones served by the company are dial operated. Work is well underway for conversion of the company's Grand Rapids exchange which is scheduled for December of this year.

These new rates go into effect with next billing date except at the Covington exchange where old rates remain in force unless on or before Dec. 1, 1954, new cable plant is installed to improve service within the base rate area.

V V

North Dakota Commission Approves Mutual's Requests

North Dakota's Public Service Commission on Aug. 11 authorized the BEK Telephone Mutual Aid Corp., Steele, to obtain a long-term loan from the Rural Electrification Administration; to establish a schedule of rates, and to purchase existing telephone facilities.

The commission further granted a certificate of convenience and necessity for the corporation to construct and operate a telephone system in Emmons, Logan and Kidder counties.

The BEK company was authorized to purchase plants and equipment of the Danbury Telephone Co. and the Kurtz Telephone Co., both of Hazleton, the Kintyre Telephone Co., and the Independent Telephone Co. and the Pursian Lake Telephone Co., both of Braddock.

The corporation was authorized to borrow $371,000 from the REA and to establish a rate schedule that will include: one-party business service, $8.50; two-party business, $7.00; rural multi-party business, $7.25; one-party residence, $4.75; two-party residence, $4.00; four-party residence, $3.50; rural multi-party, $5.25.

The commission also scheduled a hearing for Aug. 31 at Beulah on a series of requests by West River Mutual Aid Telephone Corp. of Hazen, which asks authority to:

Make a long-term loan of $373,800 from the REA to finance the purchase and construction of facilities.

Establish a new schedule of rates and charges for furnishing dial service in its exchanges at Beulah and Stanton.

Construct and operate a telephone system in Mercer, Oliver, Morton, Grant and Sioux counties.

Purchase existing telephone properties owned by the Aline Telephone Co., and the Lakeside Telephone Co., both of Beulah, and the Dakota Telephone Co. of Stanton.

V V

Chesapeake & Potomac of D.C. Granted $1,625,000 Increase

The District of Columbia Public Utilities Commission on July 29 authorized the Chesapeake & Potomac Telephone Co. of Washington, D. C., to increase gross revenues by $1,625,000 annually.

The commission found that the average net original cost of property devoted to furnishing intrastate service is $79,126,000. It determined that a return of 6.25 per cent on this plant was fair and reasonable; also that the

LONG DISTANCE SERVICE
TOLL STATEMENT
TEL. NO. AN-4206
TOLL CALLS 11 90
FEDERAL EXCISE TAX 1 19
NON-TAXABLE ITEMS
STATE TAX
TOTAL CARRIED TO BILL 13 09
THIS IS A STATEMENT OF THE TOTAL TOLL SERVICE INCLUDED ON THE ENCLOSED BILL.
THE ENCLOSED TICKETS EXPLAIN THESE CHARGES.
SHOULD YOU HAVE ANY QUESTION REGARDING THE TOLL CHARGES, PLEASE, IF POSSIBLE, BRING OR SEND THE TICKETS IN QUESTION TO OUR OFFICE SO WE MAY INVESTIGATE THE MATTER.
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–improve subscriber relations, too

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This simple operation permits centralized accounting. It cuts billing time 40%. It saves up to 99% in filing space.

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originator of modern microfilming—and its application to telephone routines

company had been earning at a rate of 5.36 per cent.

The company had requested an increase of 4.4 million dollars.

Fixing of the rate of return (6.25 per cent) was based in part on calculations by the commission showing the cost of debt to be 3.25 per cent, the cost of equity to be 8.25 per cent (with a payout ratio of 80 per cent) and an assumed capital structure of 43 per cent debt and 57 per cent equity. The commission indicated that such factors as regulatory lag, attrition, value of the service, etc., were considered in determining the allowable rate of return.

V V

Wisconsin Telephone Company Takes Over Independent

The Wisconsin Public Service Commission recently granted permission to the Rock River Telephone Co. to discontinue its service and abandon its lines in Dodge County, providing the Wisconsin Telephone Co. furnishes service to the subscribers involved (TELEPHONY, July 31, p. 32). The Rock River company served 14 subscribers.

The Wisconsin company was to begin construction of new lines immediately, according to a recent announcement.

V V

Missouri Independent Purchased By Southwestern Bell

The Missouri Public Service Commission gave recent permission to the Farley (Mo.) Telephone Co. to sell its exchange to the Southwestern Bell Telephone Co.

It is reported extensive improvements will be made in the exchange.

V V

Mississippi Company Chartered

The Sherwood Telephone Co., Merigold, filed articles of incorporation with the Mississippi Secretary of State recently.

V V

Ill. Company Gets Rate Raise

Yates City Telephone Co. was recently granted permission to make a $3,242 a year rate increase in action taken by the Illinois Commerce Commission.

V V

Illinois Company Raises Rates

The Illinois Commerce Commission on July 21 authorized the Hardin County Telephone Co., Rosiclare, to increase rates a total of $3,432 a year for its three exchanges.

ABC OF THE TELEPHONE

Concluded from page 21

end of a highway or a line on a drawing is a standard circuit convention. This letter merely associates two points on a drawing, and in this case, is in no way related to the designation assigned to the highway.

(4) *Connection originates on one drawing and terminates on another.*

A feed line marked W (White) is terminated on punching 1 of the 5AN6 vacuum tube which is located in the center of the lower apparatus mounting strip. This feed line is designated as No. 7 at the point where it merges with highway D. The indicated direction of travel is to the left.

Highway D turns upward on the drawing and feed line 7 emerges from the highway at a point to the left of the apparatus mounting strip which is second from the top of the drawing. The feed line is marked W and terminates at a bracket labeled "to signal circuit."

To trace this feed line to its destination it would be necessary to refer to the signal circuit drawing which is associated with this drawing. At some point on the signal circuit drawing a bracket labeled "to translator circuit" will be found.

Within this bracket there will be a feed line marked W which is the continuation of the same feed line shown on the translator circuit wiring drawing.

However, when the "W" feed line merges with a highway on the signal circuit drawing it may or may not be designated No. 7 as it is on the translator drawing. As mentioned previously, highway and feed line designations are associated only with the drawing on which they appear.

(To Be Continued)

V V

Missouri Independent Places $100,000 Bond Issue

Fidelity Telephone Co., Sullivan, Mo., has placed $100,000 of first mortgage 4½ per cent bonds due 1979 with Berkshire Life Insurance Co., Pittsfield, Mass., it was announced on Aug. 10.

Purpose of the financing was to refund a closed first mortgage loan and for additional funds in connection with the company's improvement program, estimated to require $375,000.

The Fidelity company serves the Sullivan, Owensville and New Haven exchanges in Missouri. It is controlled and operated by Mr. and Mrs. Clifford T. Davis. Mr. Davis is the head of Davis Construction Co., one of the well-known telephone construction companies in Missouri.

V V

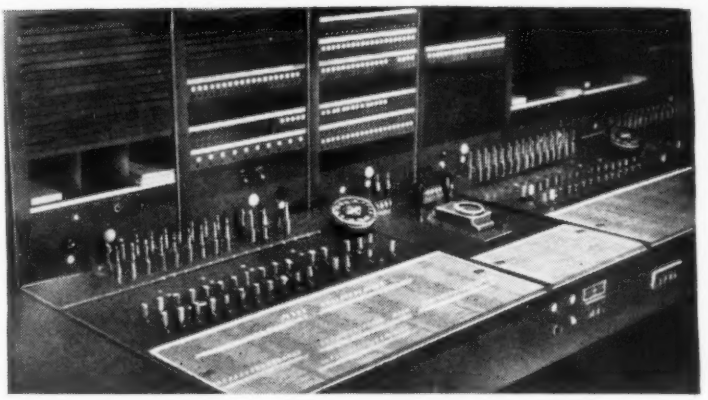
Berry Company Head in Spain

Loren M. Berry, president of L. M. Berry & Co., directory publishers, recently reported to TELEPHONY from Spain that he was enjoying his travels in Europe.

The first call made over the new Stromberg-Carlson X-Y dial system at the Woodburn (Ind.) Home Telephone Co., Inc., exchange at Woodburn was put in by the local mayor, EDWIN KELLER (seated), to the mayor of Fort Wayne, Ind. Also attending the ceremony were, standing, left to right: EUGENE E. MALLAR, plant manager; M. T. LIPSETT, secretary; EZRA SHANEBECK and PAUL E. BASTING, directors of the Woodburn company; DERWARD F. BUESCHING, commercial supervisor of the Home Telephone & Telegraph Co., Fort Wayne; and E. W. BOHREN, vice president of the Woodburn company.

CALCULAGRAPH ACCURACY!

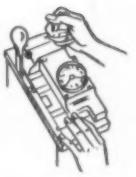
...works for you in important cost-saving ways



Photos courtesy of Automatic Electric

MODEL 33 FOR SWITCHBOARD MOUNTING - OTHER MODELS TO MEET EVERY INSTALLATION NEED

AUTOMATICALLY FIGURES TOLL TIME! With Calculagraph on the job, there is no need for time-consuming, service-slowing manual figuring of elapsed time. Calculagraph does it all quicker, easier and, most important, with complete accuracy.



ACCURATE TO THE SECOND! Calculations are accurate down to the last second. Authoritative and indisputable, they make it possible to collect all the revenue due on every toll call — a basic advantage in exchanges large or small.

PERMANENT PRINTED RECORDS! Calculagraph prints elapsed time on permanent toll tickets which make accounting methods simpler, more efficient. Toll tickets are easy to read, remain legible permanently and are available for reference at any time.

COMPLETE INFORMATION ON AUTOMATIC TOLL TIME CALCULATING AND RECORDING IS CONTAINED IN THE CALCULAGRAPH FILE CATALOGS . . . WRITE TODAY.

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Please send copy of the new catalogs on automatic toll time calculating and recording.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

THE STANDARD OF ACCURACY SINCE 1892

CARRIER SYSTEMS

Concluded from page 24

variations in carrier strength can be partially overcome by providing a pilot frequency which is electrically monitored for received strength and corrections made by means of varying the gain of an amplifier or the amount of loss placed in a circuit at the terminal or repeater apparatus. This may be accomplished with a motor driven device to cut loss pads in or out, by utilizing the varying resistance of tungsten lamps in series with the received signal, or by using thermistors to control the amount of amplifier gain.

Devices which monitor one frequency only, or all frequencies at once will provide "flat" regulation for the average received signal strength. The frequency monitored may be a frequency generated for the purpose, or in transmitted carrier systems may be the carrier frequency itself.

Correction of the "twist" or varying degrees of loss or fading encountered in systems having a wide frequency range is accomplished by using different pilot frequencies throughout the carrier range.

Frogging

As shown in the section on transmission lines, the loss on carrier systems increases as the frequency increases; that is, the high frequencies lose more than the lower ones. As also explained, the temperature changes of the line affect different frequencies differently, resulting in a "twist" of the carrier transmission slope curve.

A great deal of this effect can be cancelled out, even before regulators get a chance to work on the circuit by a system of switching frequencies known as "frogging." With this method, a channel which is a high frequency is transmitted from a terminal and dropped down to a low frequency when it passes through the first repeater. The low channels are raised in frequency at the same point. At the next repeater, the process is reversed. The high frequency channel which was dropped to low frequency at the first repeater is raised back to high frequency at the second repeater. The channel which started out low, was raised to high at the first repeater, becomes low again at the second repeater.

This may be shown as follows:

	Frequencies Used			
Channel	Terminal	First Repeater	Second Repeater	Terminal
12	260kc	44kc	260kc	44kc
1	164kc	140kc	164kc	140kc

The channels between one and 12 would be switched in a similar manner but to a lesser degree. The switching of frequency is accomplished at each repeater point by means of modulators. These consist of oscillators which mix a frequency with the received carrier frequency, and send the appropriate sideband on to the next repeater.

In the example above, a 304kc oscillator is used. The 260kc Channel 12 frequency subtracts from this to get the 44kc which is sent on to the next point. At the receiving end a similar oscillator is used to restore the 44kc to 260kc before it is sent into the receiver unit of the carrier terminal.

This method of "frogging" derives its name from the railroad practice of leap-frogging one train around another on a passing track. In a sense, the carrier frequencies leap-frog over one another by this change of frequency.

Another feature of the frogging system is the use of the different frequencies in opposite directions. In the example above, transmission in one direction only is shown. Transmission in the opposite direction would use opposite frequencies. For instance, Channel 12 in the left hand terminal is shown as leaving at 260kc. In this system Channel 12 would be received at 44kc. By this arrangement, cross-talk and feedback is minimized; there is little chance that the transmitted carrier on any one channel will feed back in the cable to its own receiver because of the different frequencies.

It will be seen, then, that frogging largely overcomes the line effect which reduces transmission more at high frequencies than at lows. Any one channel is a high frequency for a few miles, then a low frequency for another few miles, and back and forth until the distant terminal is reached. Thus the loss on Channel 12 in one cable section is matched by a similar loss on Channel 1 in the next section.

In this connection it should be noted that the lowest frequency channel—Channel 1—is changed very little in the frogging, from 164kc to 140kc, while Channel 12 makes a big change from 260kc to 44kc. This is further evidence that the higher the frequency the greater the loss and the greater the correction that is needed.

Frequency frogging, plus the various means of regulation already described, work together in carrier systems to provide an acceptable grade of commercial transmission. Together, they take care of the vagaries of the transmission line in all kinds of weather.

However, one more device, the compressor-expandor is also used to improve transmission and reduce noise. Before going into the operation of this equipment, a clear understanding of the operation of crystal diodes is necessary, which will be described in the next article.

The Sumter exchange of the Sumter (S. C.) Telephone Co. recently was cut over to automatic operation. Left photo shows the new Sumter modern air-conditioned central office building. Right photo shows Sumter mayor, MISS M. SHAW making first call over the new system, with GORDON SAUNDERS, president of the Sumter Telephone Co., looking on. The Sumter exchange has the 2-5 numbering plan for the nationwide toll dialing system.

"It's no use...I'll never make it... the finish line is way up by the next pole."

• No wonder our exhausted athlete feels like giving up. Usually "the next telephone pole" isn't very far away. But these poles are strung with Amertel 135, and they're 2½ times as far apart as poles strung with ordinary BB wire.

Here's why it's a good idea to use Amertel 135. It saves work . . . requires less hauling, less digging, fewer man-hours of labor per mile. It saves money . . . you need fewer poles and less pole hardware, and your maintenance bills are lower. And it saves worry . . . the increased strength of Amertel 135 results in better service, fewer breakdowns.

We'll be glad to send you more detailed information on Amertel 135. Write to American Steel & Wire Division, Rockefeller Building, Cleveland 13, Ohio.

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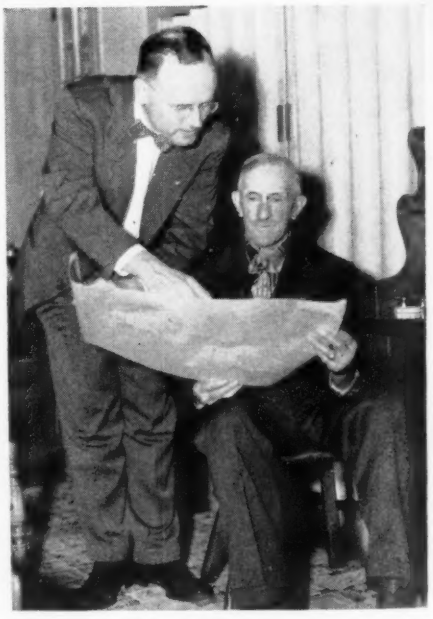


The main plant and offices of the Orange County Telephone Co., Middletown, N. Y. (above); Frank D. Fancher, vice president and treasurer of the Orange County company, shown with two early model telephones (right, above), and (lower right photo) John Ayers (right), 81-year-old pioneer in the industry, discussing cable routing plans with his successor, Alton Bradner, plant manager of the Orange County company.

These photos and 11 others were part of a feature full-page story in the Middletown (N. Y.) *Times Herald*, signalizing the 60-year history of the company which was founded by Dr. Edwin Fancher, father of Frank D. The old model telephone Mr. Fancher is holding is the first desk type used in Orange County; it was on his father's desk during all his year's as president of the company. Charles C. Chappell is president of the company today.

The history of the main offices dates from 1914 when the far right of the front section was built; facade and near wing date from 1929; the third section from 1936, and the new rear of the building was built in 1946. Another rear addition is expected to be necessary within six years.

The company is presently fifth largest among 115 New York Independents. Last year, with nearly 14,000 stations, it became one of 75 Independent companies in the United States to pass the one-million-dollar level of annual gross revenues. The company was the first in the Hudson River watershed to convert to dial, having installed a $200,000 system in 1928. Summarizing the company's growth, the newspaper stated, "From 50 stations in 1896, there were 1,610 in 1910, 4,249 by 1925, 8,390 by 1945 and 13,857 at last count in April."

Central Company Places $1,500,000 Bond Issue

Paine, Webber, Jackson & Curtis and Loewi & Co. jointly head an investment group offering publicly on Aug. 10, 1½ million dollars of 4½ per cent convertible subordinated debentures of Central Telephone Co. The debentures are priced at 100 per cent to yield 4.50 per cent to maturity.

The debentures may be redeemed at prices scaled from 104 to 100.25. Each debenture is convertible into shares of common stock of the company at prices ranging from $17.50 from May 1, 1955, to Apr. 30, 1960; at $18.50 from May 1, 1960 to Apr. 30, 1965; and at $19.50 thereafter.

Proceeds from the sale of the debentures will be used for making temporary advances to subsidiaries for construction purposes, for investment in stocks of subsidiaries and for other corporate purposes. Construction expenditures of the company and subsidiaries are estimated at $6,800,000 for 1954.

The company and its subsidiaries provide telephone service to 143 exchanges in nine states.

Capitalization of the company, giving effect to the current issue, will consist of: $8,204,000 in long-term debt; 64,205 shares of $50 par value cumulative preferred stock in three series; and 521,813 shares of common stock, $10 par value.

Others associated in the offering include:

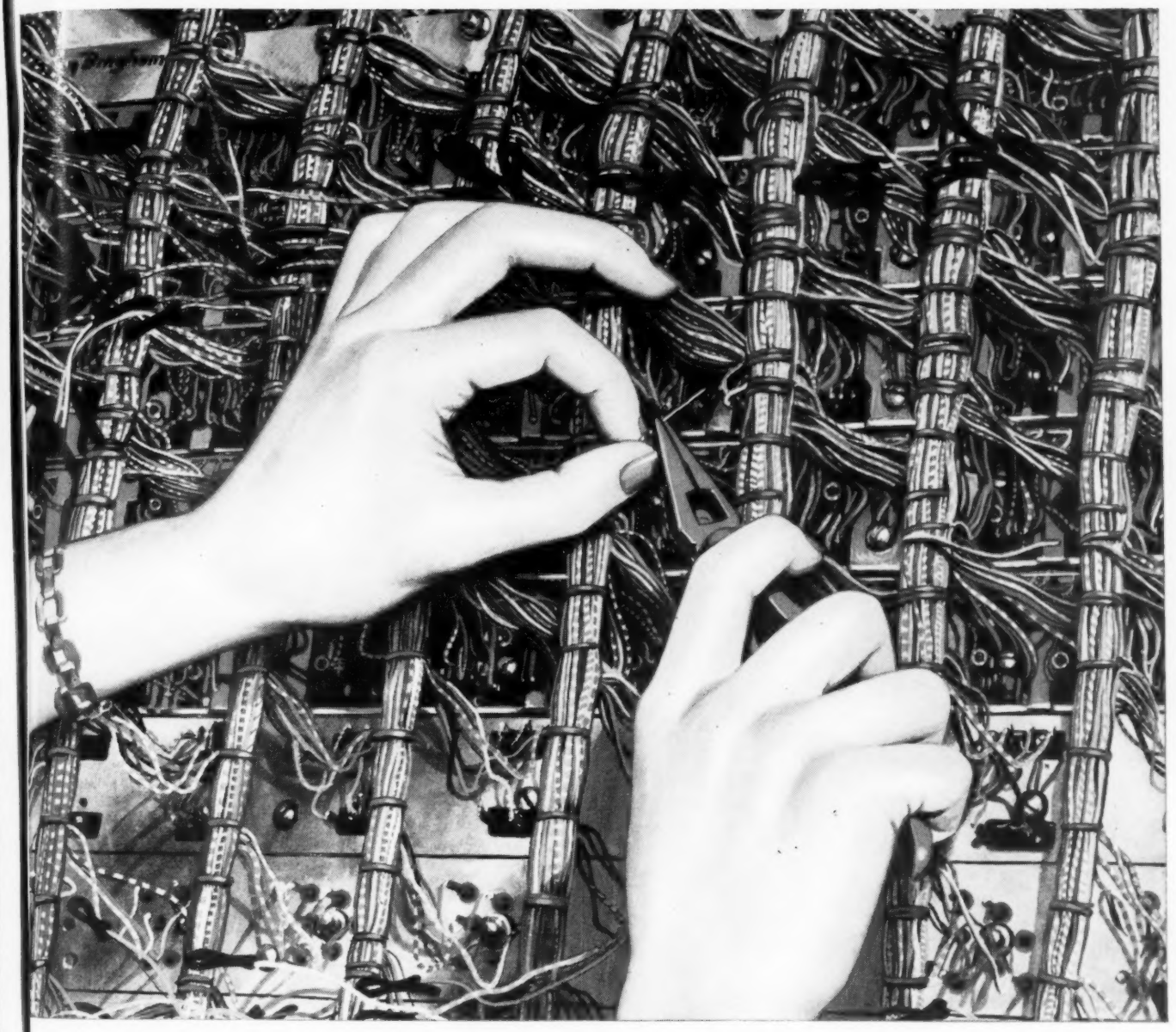
Central Republic Co. (Inc.)
The Milwaukee Co.
Bell & Farrell, Inc.
Boenning & Co.
First Securities Corp., Durham, N. C.
McCormick & Co.
Scott, Horner & Mason, Inc.

Nation's Telephone Workers Saluted by Ballantine

The 685,000 telephone workers of the nation received a special salute when the Ballantine Brewery recently dedicated its radio and television broadcasts of a New York Yankee baseball game to the men and women who make possible the excellent telephone service enjoyed in this country.

During the broadcasts Ballantine's sportscaster, Mel Allen, described the various duties performed by the telephone workers "from the pleasant-voiced operators to the husky linemen who repair the communications wires in all kinds of weather."

Allen also explained the vital role that the telephone workers play in the day-to-day activities of the nation, and gave statistics on the number and types of calls placed each day.



Hands that help you say "HELLO!"

These are the hands of a girl at Western Electric, wiring switching equipment that goes to work in your Bell telephone central office when you make a call.

This equipment will take its place in the biggest, most complex machine in the world—the nation-wide network of the Bell Telephone System. Making the parts for this ever-changing, ever-growing machine—telephones, switchboards, wires, cables—has been Western Electric's job for over 70 years.

New or old, these parts must all work perfectly together. And they do—for a good reason.

It's this: Western Electric—as the *manufacturing* unit of the Bell System—works in closest touch with Bell Laboratories people who *design* the equipment and Bell telephone company people who *operate* it. We're all part of the same outfit—the Bell System. Together we help you say, "Hello!"—to almost anyone, anywhere.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Carl L. Spaid Recuperating in Kansas City Hospital

Carl L. Spaid of Kansas City, Mo., president of the United Telephone Co. of Missouri and the United Telephone Co. of Kansas, has been confined to the Trinity Lutheran Hospital, 30th and Wyandotte, Kansas City, following a recent illness.

Mr. Spaid was in Chicago on business when he became ill and was immediately flown to Kansas City.

Mr. Spaid is president of the Missouri Telephone Association, past president of the Kansas Telephone Association, and past president of the Theodore Gary chapter of the Independent Telephone Pioneer Association.

Following his stay in the hospital he will rest for a while in his home at 31 W. Dartmouth, Kansas City, Mo.

V V

Cal. Company Sells $2,000,000 Stock Issue for Construction

California Water & Telephone Co., Monrovia, Cal., sold 80,000 shares (2 million dollars) of $1.20 dividend preferred stock to two New York insurance companies, it was reported on Aug. 9.

According to Chester H. Loveland, president, proceeds of the new $25 par stock will be added to the utility's 6.5 million dollar 1954 construction program. The purchasers were New York Life Insurance Co. and Mutual Life Insurance Co. of New York.

V V

OBITUARIES

JAMES L. HOLMES, 53, manager of the Lucas County Telephone Co., Chariton, Iowa, for the past 11 years, died recently of a heart attack.

He started with the Lucas County company 29 years ago as lineman.

Mr. Holmes had recently been elected to the board of directors of the Iowa Independent Telephone Association.

* * *

CHARLES A. FARRINGTON, 83, veteran of 54 years in the Independent industry, and president and manager of the Appanoose Telephone Co., Centerville, Iowa, died, it was reported recently.

He founded the Appanoose company over 50 years ago. He was also active in the work of the Iowa Independent Telephone Association, having been a director from 1918 until the time of his death. He was president from 1936 to 1938.

V V

Kansas Company Has New Owner

The Sterling (Kan.) Telephone Co. has been purchased by Howard K. Culbertson, it was reported recently. The company which also has an exchange at Alden, will convert to the dial system, the new owner has announced.

V V

Telephone Men in Controllers Institute Appointments

Three telephone company executives have been elected presidents of local chapters of the Controllers Institute of America. O. T. MacMillan, vice president and controller, New York Telephone Co., is the new head of the organization's New York City Control. The newly elected president of the Vancouver Control is George W. S. Montgomery, auditor, British Columbia Telephone Co. Edward J. Powell, vice president and comptroller, Porto Rico Telephone Co., San Juan, has been similarly honored by the Puerto Rico Control of the Institute.

At the annual meeting of the District of Columbia Control, Robert W. Michie, vice president, Chesapeake & Potomac Telephone Co., was chosen secretary.

E. R. Koogle, comptroller, Chesapeake & Potomac Telephone Co. of Baltimore City, has been named secretary-treasurer of the local controllers' group.

The following have been elected directors of Institute Controls in their respective areas: Ferry B. Allen, assistant comptroller, Michigan Bell Telephone Co., Detroit; Mark W. Cummings, comptroller, Southwestern Bell Telephone Co., St. Louis; James A. Hobbs, assistant comptroller, The Bell Telephone Co. of Canada, Montreal; Arthur S, Gibson, vice president-finance, Rochester (N. Y.) Telephone Corp.; Eugene M. Robinson, Louisiana auditor, Southern Bell Telephone & Telegraph Co., New Orleans, and W. Bernard Thulin, comptroller, The Chesapeake & Potomac Telephone Co. of Virginia, Richmond.

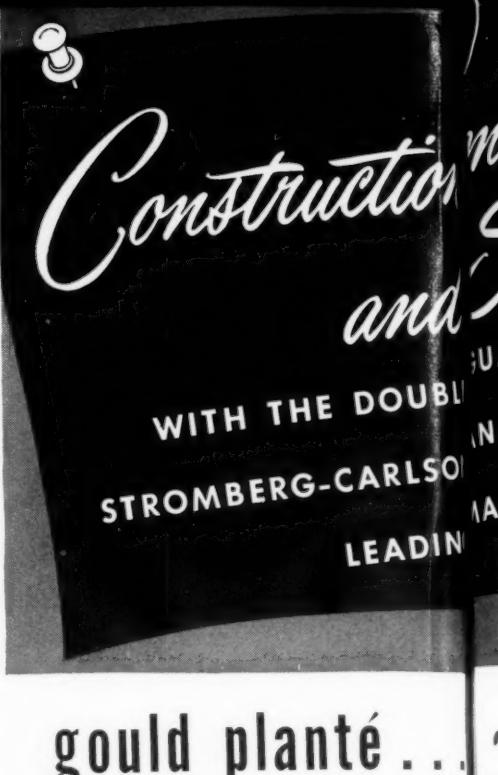
Established in 1931, the institute is a non-profit organization of controllers and finance officers from all lines of business—banking, manufacturing, distribution, utilities, transportation, etc. The total membership exceeds 4,300.

V V

"The manner of your speaking is full as important as the matter, as more people have ears to be tickled than understandings to judge." — CHESTERFIELD.

V V

"Just as people are able to do better by reviewing their past and avoiding some of the errors they have made, so can we as a self-governing people profit by reviewing the history of our nation." —MANSFIELD (PA.) ADVERTISER.



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Many Planté batteries are still in active fu
float service after twenty, thirty, even for
years! That's because Planté plates a
heavy, solid sheets of pure lead. In the
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Cook PLX

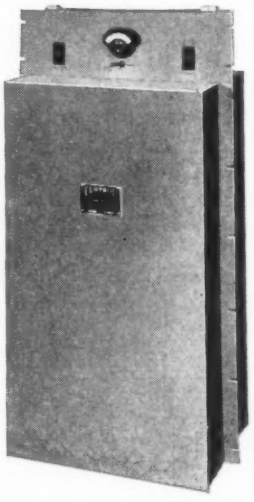
plastic loop unprotected cable terminal

Simple to install—requires no stubbing, no splicing, no potting. Simplicity gives you economical freedom from maintenance. Heavy galvanized steel frame and deep drawn chamber, welded zinc cover, and the famous XB Bakelite face plate with heavy Everdur studs comprise the major features of this new Plastic Loop Unprotected Pole Cable Terminal.

When ordering, specify cable size so that correct size grommet is installed.

Manufactured by Cook Electric Company

no moving parts—and constant within ± 1%!



Model
1200 B
24 Amps.
50 Volts

flotrol automatic battery charger

Since operation of the FLOTROL does not depend on tubes, relays, motors or other "expendable" equipment, its dependability is outstanding. In performance record tests, amazing accuracy of voltage regulation has been recorded even when the supply voltage ranged from 105 to 125 volts, and the load varied from less than 10% to over 100% of rated value.

Complete overload protection is automatic with FLOTROL. Even if connected to a discharged battery, component parts remain undamaged.

WRITE for Bulletin 160—a complete catalog of FLOTROL Models for single-phase operation.

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guy and messenger galvanized strand

The superior tensile properties inherent in steel are used to full advantage in *Crapo* Galvanized Strand. The tightly adherent zinc coating applied by the *Crapo* Galvanizing Process provides lasting protection against corrosion, and prolongs the life of the strand. Controlled ductility makes *Crapo* Strand easy to work and to serve. Low first cost and low yearly cost result in important economies for operating companies.

The all-round dependability of *Grapo* Galvanized Steel Strand is being demonstrated constantly by its outstanding performance in service. There is a size and grade for all practical needs.

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High Fidelity Radios and Radio-Phonographs

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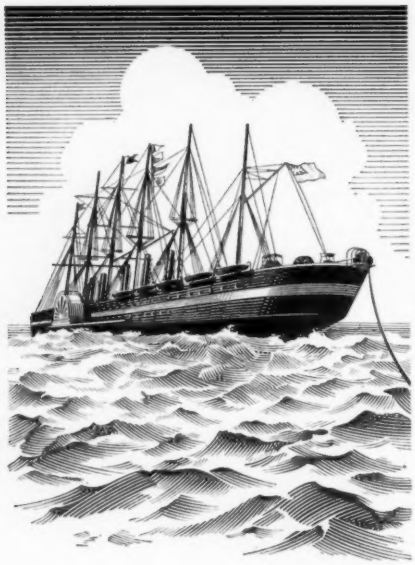


Spanning the Ocean

July 27, 1866 marks a famous day in communication history. For, after four failures, the Atlantic cable was permanently completed from Valentia, Ireland, to Trinity Bay, Newfoundland. Merchants in Chicago and New York were only minutes, rather than weeks, away from merchants in London and Amsterdam.

It is significant to note that the first Hemingray Glass Insulators were made in this same era. In fact, for 84 years now, Hemingray has been dependably serving the communication systems of the world.

Experience and research have made Hemingray Insulators the finest obtainable today. They are available for immediate delivery at most jobbers . . . in any quantity . . . in types for all telephone and telegraph pole lines. Send for a free catalog. Kimble Glass Company, subsidiary of Owens-Illinois

HEMINGRAY INSULATORS

AN (I) PRODUCT

OWENS-ILLINOIS

GENERAL OFFICES · TOLEDO 1, OHIO

news on new PRODUCTS

REGULATED BATTERY CHARGER—No longer is it necessary for two-way radio-equipped vehicles to keep engines idling while off-the-road work is being done. Truck batteries can now be charged right in the field with a new regulated battery charger, designed primarily for utility work trucks equipped with two-way radio and other accessories requiring a six-volt dc power supply. It is manufactured by D. W. Onan & Sons Inc.

Devised for use in the field with an Onan ac electric generating plant, this compact 12 inch x 10½ inch x 9¾ inch battery charger keeps batteries charged at a minimum of cost. It draws its ac input power from the auxiliary electric plant . . . takes over the dc load . . . charges the six-volt storage battery and provides up to 25 amps. for powering the two-way radio equipment before any demand is made on the battery.

The unit can be used in any garage, service station or other building utilizing 110-125-volt, 60-cycle current.

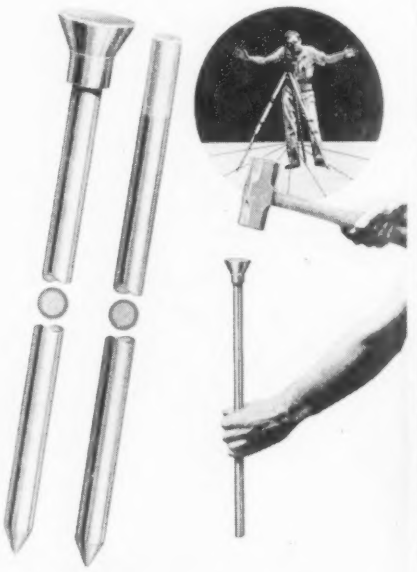
The charger consumes about 500 volt-amperes, leaving the remainder of the ac output of the Onan auxiliary electric generating plant available for operating drills, saws and lights. Painted an attractive gray, the unit has completely automatic charge rate regulation with a maximum rate of 25 amps., tapering to 3 to 5 amps.

The charger contains no moving parts. The charge rate is controlled by a magnetic amplifier. An automatic reset circuit breaker protects the charger against overload. Request NP 297.

• • •

SURVEY MARKERS — The Copperweld Steel Co. has introduced new survey markers which will locate survey points permanently and eliminate bothersome, annoying disputes. The use of these non-rusting copper-covered steel markers will perpetuate the results of the surveyor's skill and provide property owners with the protection of permanently-marked boundary lines.

Each marker consists of a strong steel core to which a thick copper covering is inseparably molten-welded. This provides strength for easy driving without splintering, bending or breaking and, at the same time, assures long life.



There are two types. The tinned-end marker has high visibility from the 1½-inch brightly-tinned end. It is made in ½ or ⅝-inch diameter, and is ideal for use in uneven or heavy-foliaged ground. The other type has a compression-fit 1½-inch diameter bronze head, which

TELEPHONY PUBLISHING CORP.
608 S. Dearborn St.
Chicago 5, Ill.

Please have the manufacturer send me without obligation the literature indicated by the following numbers:

NP297____; NP298____; NP299____; NP300____; NP301____;
NP302____; NP303____; NP304____; NP305____; NP306____;
NP307____; NP308____.

Name . . . . . Title . . . . .

Company . . . . .

Street . . . . .

Town and State . . . . .

8/21/54

provides ample space for center-punching the precise point of reference. It can be driven flush with pavements, roadbeds, bridge buttresses or other surfaces. The bronze-head marker is furnished in ⅝-inch diameter.

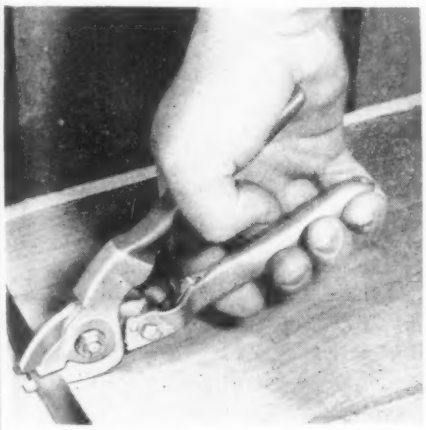
In the event these survey markers are buried a few inches under the surface, they can be located easily by using a dip needle. This is an important feature.

Standard lengths are 3 feet. Ten markers, of either type, are packed in a handy carton, which when opened becomes a convenient storage bin. Other sizes and packaging may be furnished on special order. Request HP 298.

• • •

CUTTER—H. K. Porter, Inc., has announced a new one-hand 8T cutter to meet all the requirements for cutting steel strapping and wire binding in shipping rooms.

As a result, according to the company, this cutter embodies many new features, all of which add up to time-saving ease of operation. For longer cutting life there are heat-treated blades.

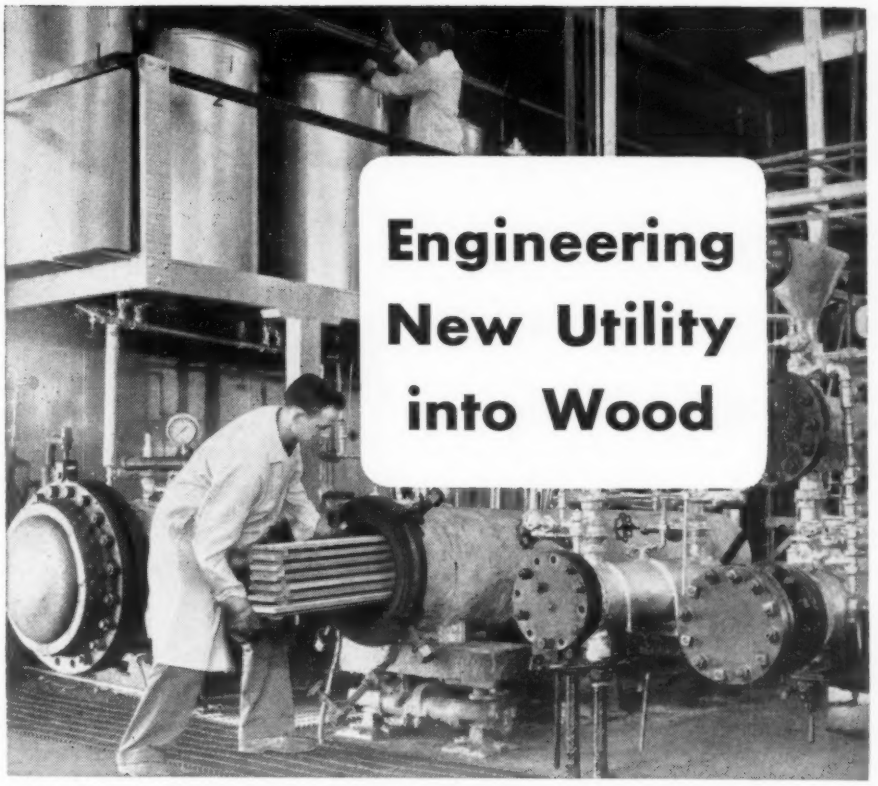


For hand comfort there are plastic cushion grips which prevent blisters and keep hands from slipping. For faster operation there is a spring which keeps tool open to cutting position and a thumb lock which keeps tool safely closed when not in use. It's light weight yet powerful; compact in design to fit into pocket.

The sharp pointed lower jaw fits easily under the tightest strapping or baling wire for quicker cutting and the thin, flat blade prevents damage to either container or contents. A notch in the lower blade keeps round wire in position for cutting—the wire won't slip out, and a "keeper" makes sure that strapping or wire stays straight in the jaws when pre-cutting. Request NP 299.

• • •

ROCK DRILL—Homelite Corp. has announced a new Bosch electric rock drill. Said to eliminate the need for



These wood-treating cylinders vary in size from 2" x 12" to 4' x 20'. They make possible detailed studies of wood ranging from test-tube quantities to semi-commercial quantities.

at the Koppers Technical Laboratory

• Koppers Poles and other pressure-treated products have proved their worth by giving customers long and satisfactory service. But Koppers Company doesn't rest on its laurels. At its Technical Laboratory in Orrville, Ohio, Koppers works to improve its products so that they will do an even better job for you.

Here, in one of the most complete wood-treating laboratories in the world, Koppers technicians conduct exhaustive tests on the prevention of wood deterioration. They have the most modern equipment at their disposal.

For example, a man-made "tropical jungle" accelerates the rate of decay in wood and thus provides samplings for study. Impact-testing machines determine the loss of strength caused by the various agents that attack wood. There is a battery of pressure cylinders for impregnating wood with various preservatives and for testing all known treating procedures.

This continuing program of research is another way in which Koppers is hard at work to make wood serve you better and more economically.

SEND US YOUR PROBLEMS!

If you have any problems dealing with wood, submit them to us. Our technicians will then recommend the proper preservative treatment to meet your needs. If you wish, you can send us a sample of wood that has failed. We will perform an "autopsy" and tell you *why* it failed and how to prevent future trouble.

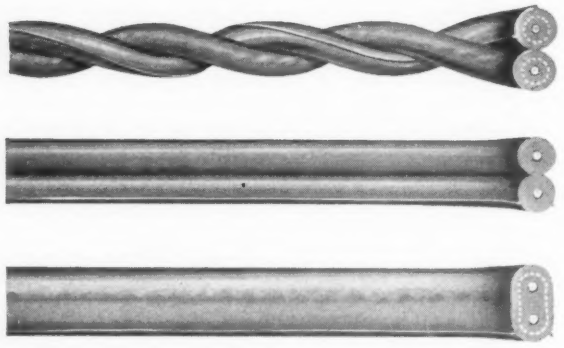
KOPPERS COMPANY, INC.

KOPPERS **PRESSURE-TREATED WOOD**

® Wood Preserving Division, Pittsburgh 19, Pennsylvania

PHELPS DODGE
TELEPHONE DROP WIRE

ALL TYPES—FOR HEAVY DUTY SERVICE



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for reliability.

Neoprene sheath
for high resistance to
abrasion and weathering.

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A complete line of telephone wire distributed exclusively by Stromberg-Carlson

PHELPS DODGE COPPER PRODUCTS CORPORATION

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CORPORATION

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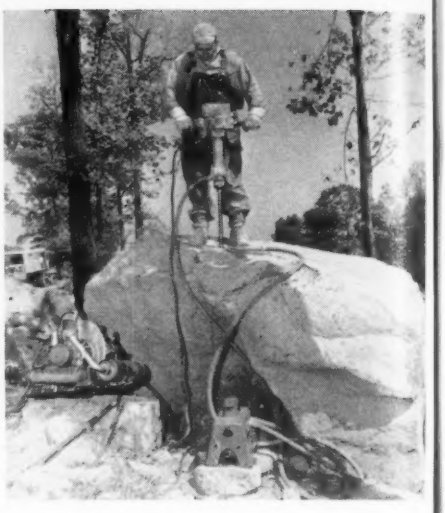


big, costly-to-maintain air compressors, this versatile drill is powered by a lightweight, rugged, high cycle motor requiring no brushes. It is operated from an easily carryable Homelite generator weighing only 130 pounds.

The rock drill, equipped with the Bosch pressure blower, drills blasting holes, wedge holes, split holes and anchor holes in the toughest rock, concrete or brickwork. The manufacturer claims that this trouble-free tool will drill holes 18 feet deep and will operate with a minimum of vibration and noise.

The Homelite Corp. has been assigned sole distributor for the Bosch rock drill and its high cycle companion pieces—a light duty pavement breaker and a builder's hammer for such tasks as chipping, spading, vibrating, nail driving, etc. This builder's hammer is also available with a 115-volt universal motor to operate from standard house current. Request NP 300.

• • •

EMERGENCY LIGHTING—The Nickel Cadmium Battery Corp. announces its new Nicad emergency lighting unit, designed to provide an auxiliary 6-volt light source which will come on instantaneously and automatically when the normal ac supply fails. Heart

of the unit is this manufacturer's Nicad steel encased, alkaline storage battery.

Nickel cadmium batteries have long been used in vital power services in Europe, but Nicad is the first nickel cadmium battery to be made in America. It has characteristics of long life and freedom from need of care—both desirable in the emergency lighting field.

Mounted on top of the unit are two 6-volt lamp heads and reflectors. Front panel mounting includes a high-rate charge timer that can be set from 0 to 12 hours, an amber neon "readiness" light, a red neon "high rate" light, a 6-volt light switch and a push button test switch. A removable sub-assembly carries the transformer, rectifier, cut-over relay, timer, trickle-charge resistor and all other components.

The circuit is designed to maintain the Nicad battery on trickle-charge and to permit recharging the battery within 12 hours. The duration of the high rate charge is set by the timer. The red neon pilot light, indicating that the high rate is on, goes out when the charge is completed. The amber neon pilot light indicates that the a-c is on and the unit is in standby condition, ready to operate. If the 6-volt light switch is open, the amber light will be out, thereby indicating the unit is not in "readiness" condition. The push button test switch makes it possible to check operation of relay, battery and lights. Request NP 301.

• • •

TAPING GUN—Electrical harness wrapping can be speeded up from two to 10 times using plastic tape dispensed by a new "taping gun" marketed by Minnesota Mining & Manufacturing Co.

Called the "Scotch" taping gun, model E-2, it is specifically designed for ¾-inch-wide "Scotch" brand plastic electrical tape No. 33.

Weighing less than 20 ounces with a

YOU BUY DEPENDABILITY

WHEN YOU BUY A

RAYTHEON RECTICHARGER

(BATTERY CHARGER)

Dependability is the number one requirement of equipment for the Telephone Industry.

RAYTHEON ENGINEERING REPORT

SUBJECT: Oldest RectiChargeR

Careful testing and inspection of this unit reveals:

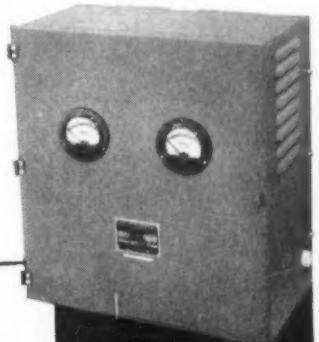
1. Electrical qualities in no way impaired (see chart).
2. A noticeable lack of rust or corrosion on chassis, hardware and components.
3. Original paint shows no sign of deterioration.
4. No evidence of embrittlement or cracking in varnish on magnetic components.
5. All hardware sound and secure.
6. Cable firm and unbroken.
7. Lacing intact with all wiring firmly in original position.
8. All soldered joints secure and strong.

(Signed) George L. Blais
ENGINEERING DEPT.

The dependability of Raytheon RectiChargeRs is amply demonstrated by the service records of units now in use. A typical example is shown in the Engineering Report at the right. And there's no reason why the "old" RectiChargeR described in the report can't go on giving the same faithful service for many more years.

It's no accident that Raytheon RectiChargeRs are setting performance records. Every detail of electrical and mechanical design has been carefully worked out with dependability as the guiding principle.

You get dependability automatically when you buy a Raytheon RectiChargeR, just as you get fully automatic battery charging — with constant voltage output over the complete load range regardless of input change — without under or overcharging.



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EQUIPMENT SALES DIVISION
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INTERNATIONAL OPERATIONS: 589 FIFTH AVE., NEW YORK CITY

RAYTHEON PRODUCTS INCLUDE: RectiChargeR* battery chargers; RectiFilteR* battery eliminators; Voltage stabilizers (regulators); Transformers; Tubes and other electronic equipment.

*Reg. U. S. Pat. Off.

Specify Raytheon RectiChargeRs and RectiFilteRs for completely dependable Telephone service. Your supplier offers a complete line for all requirements. Ask him for details or write direct.

STEP UP YOUR SAVINGS and EFFICIENCY with the...

YORK-HOOVER

Model 4986 SERVICE BODY

Realize those *extra* dollars by investing in York-Hoover Body Equipment. Model 4986 Service Body, for example, is providing outstanding every-day service records in all sections of the country. Built in stability assures an absence of trouble-some detail repairs, so costly in terms of time and money.

Model 4986 Body is actually a "mobile stock room" having specially designed—from experience—bins, drawers, and compartments for carrying material and tools. Easy access, and in plain view for inventory purposes, parts and tools are always there when needed. This assures increased efficiency as well as additional savings—always important in your operation.

Functional use is enhanced by the addition of an aerial ladder, one man operated, with minimum effort.

Facts are available—Bulletin No. 934 provides them. WRITE TODAY!

York-Hoover Corporation
YORK, PENNSYLVANIA
Body Division

36-yard roll of tape in the circular magazine, the lightweight gun makes it possible to bundle the wires and cut the tape in a single easy motion taking approximately one second.

In use, the tape protruding from the end of the gun is stuck to the wires by the thumb, threaded around the bundle by the curved tip, and then cut with a touch of a thumb button. The end of the tape is pressed down to complete the wrap.

The slender, 10½-inch, curved tip serves as a convenient "needle" to thread the tape around wires on a cable layout board or in spots which would be difficult to reach.

With the exception of the grip and cutting button, which are molded from high-impact styrene plastic, the taping gun is of all-steel construction.

Advantages of plastic tape for electrical harness wrapping as compared to previous methods using twine include drastically reduced time and cost, elimination of any danger of cutting the insulation and freedom from attack by fungus—especially important where warm, moist conditions prevail. Request NP 302.

• • •

ELEVATOR FILE—Diebold, Inc., recently announced the development and production of the new super elevator file for improving operating controls and cutting handling costs on large volume record systems. Each file provides ready accessibility to as many as 300,000 records and is designed to save operator's time and effort and to conserve valuable floor space.

To operate the new super elevator file, a pushbutton is pressed until the desired tray comes into working position.

This motorized file has an "electrical brain" which automatically brings each group of trays to the operator by the shortest route. No record is more than three seconds away from the operator's

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Kennecott Telephone Cable has achieved a reputation for long-lasting service.

Every step of the way—from raw materials to final product, Kennecott experts check and re-check to make certain that all Kennecott cable is of the finest quality.

Kennecott is the name to remember when you order cable. Call your nearest Chase sales office for full information.

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Boston	Dallas	Indianapolis	Minneapolis	Providence	
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Reduce installation costs

in underground cable systems

Transite* Ducts speed installation. Lightweight, long lengths are easy to assemble; save time and labor.

Transite Ducts are adaptable. Readily cut and tapered in the field. Full line of fittings simplifies directional changes.

Transite Ducts ease cable pulling. Smooth bore reduces friction and abrasion . . . permits easy insertion or removal of cables.

Transite Duct installations are permanent because they are immune to rust, rot and electrolysis . . . resist corrosion and withstand all normal soil stresses.

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. When the tray reaches the orking position, the mechanmatically stops, even if the continues to press the button. re within easy reach for ref- posting when operator is standing.

re of the super elevator file finding," which aids the oplocating the desired record. re spread before the operator ighted area where guides can in a glance—taking the opt to the desired record.

er elevator file utilizes a wide record sizes and weights. It b cards and all popular sizes cords — no transcription of cords to special cards is required.

The lightweight 10-inch deep tray used in the file offers the operator a short reach so that records anywhere in the tray are easily accessible without stretching. This short-depth tray also increases visibility of guides and records.

Trays are lightweight, portable and completely interchangeable. They can be lifted out of the file easily and can be re-arranged as desired. Various sizes of trays for housing records of different sizes can be used in the same file. Multiple short trays offer good record breakdown and grouping, permit division of the work at peak periods. They are designed to open a filing "V" anywhere and to hold the place automatically until the record is returned. No place markers are necessary.

The large volume of records housed in a small area by the Super Elevator File makes it particularly suitable for such public utility and carrier applications as meter location records, pole records, customer records, maintenance and pricing records, appliance service records and stub accounting systems.

The new Super Elevator File operates on standard 110-volt alternating current. In the event of power failure, the elevating mechanism can be operated by a hand crank. A positive safety device automatically and instantly stops the mechanism if the operator's hand or any other object extends over the back of the posting shelf. The steel cabinet is finished in baked-on fine-wrinkle gray enamel and is equipped with a roll-top locking cover. Request NP 303.

• • •

PAPER HANDLING EXPEDITED—Sortkwik, a handy, new fingertip preparation that expedites paper handling of all kinds, has recently been developed by Lee Products Co.

Quickly applied, Sortkwik leaves a greaseless, stainless, tacky film on the fingertips making even the slipperiest

Speeds handling and sorting of papers, cards and currency.
SORTKWIK
Replaces unsanitary sponges and rubber fingers.
Not Harmful to Skin. Washes Off Readily
Apply to Thumb and Forefinger of Each Hand. Rub in Well
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2736 Lyndale So., Mpls. 8, Minn.
Slide

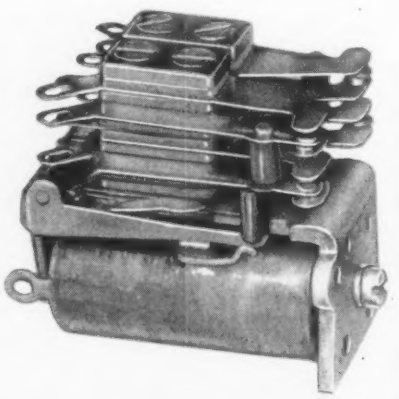
papers easy to handle. A pleasant to use preparation, it replaces clumsy rubber fingers and unsanitary sponges. Sortkwik is completely harmless and washes off readily.

Sortkwik is recommended for every operation requiring extensive paper handling such as sorting, collating, filing, counting, etc.

Sortkwik is packaged in a handy, flat, unbreakable plastic container. Request NP 304.

• • •

SPECIAL PURPOSE RELAYS—Designated Leach Part No. 8-4C. New versatile, miniature, telephone type relays for all forms of communication applications. Also electronic control circuits, computors and other types of instrumentation, plate circuits, remote controls, etc. Designed to insure positive,



long-life operation, have extremely low friction loss and withstand extreme vibration at minimum power consumption. Following are the characteristics of these new relays:

Contacts: Palladium, standards: various contact arrangements up to a maximum of 4PDT, 6PDT, or 2D (make-before-break) can be obtained by combinations of basic types.

Ratings: 3 Amps. @ 32 VDC, resistive: 3 Amps. @ 115 VAC, non-inductive: type number 8—followed by contact designation.

Coils: DC only—up to 8,000 ohms: nominal, 2.8 Watts; maximum, 3.85 Watts; maximum sensitivity, 90 mw for SPDT; 750 mw for 4PDT; Typical Coil: 235 ohms ± 10 per cent for 26.5 VDC.

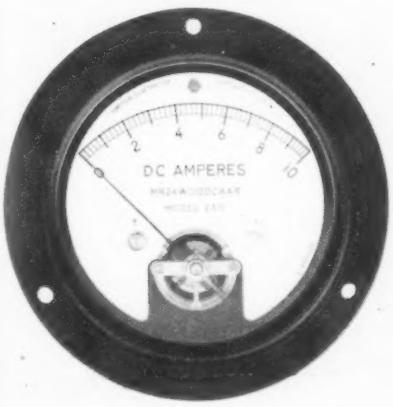
Insulators: XXX phenolic, standard.
Vibration: 10 G to 55 CPS.
Shock: 25 G.
Weight: 2.25 ounces.
Dimensions: Length 1-7/16 inches;

height 1-11/32 inches; width 15/16 inches.

Also available hermetically sealed in miniature nine or 14-pin plug-in, or solder terminal types. Request NP 305.

• • •

PANEL INSTRUMENTS — Simpson Electric Co. announces an addition to their complete panel instrument line.



These new meters will be made with dc ranges showing any practical scale from 300 microamperes to 800 milliamperes. Meters will be available in two sizes—2½ inches and 3½ inches. Request NP 306.

STRAND CABLE TERMINAL — Reliable Electric Co. is now producing a line of cable terminals for strand, pole and wall mounting employing reinforced cast resin binding post terminal blocks with lead sheathed paper insulated and plastic sheathed plastic insulated cable stubs, suitable for use in cable systems maintained under gas pressure.

The 11-pair and 16-pair terminals are designed primarily for attaching to strand supported cable, affording plant flexibility and minimum chance of damage. Where it is impractical to mount them on the strand, they can be placed in a vertical or horizontal position on poles or walls by using a detachable mounting bracket.

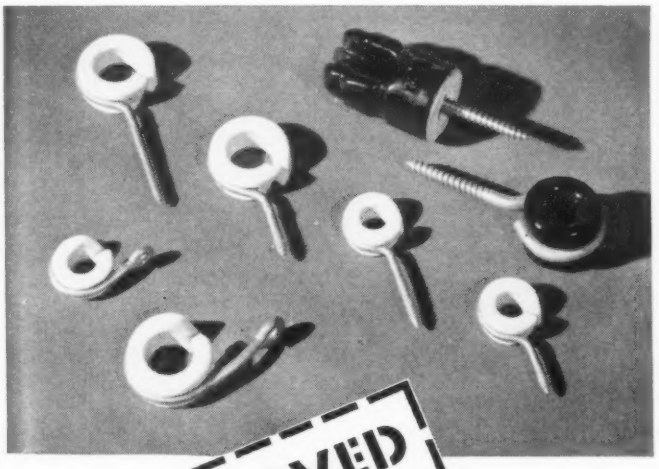
A 26-pair terminal is designed for mounting vertically on poles or walls. Detachable mounting bracket is furnished standard with all 26-pair terminals.

The cast aluminum alloy housings of the 11- and 16-pair terminals are equipped with stub cable entrance holes at opposite ends to facilitate the reversal of stubs where desired. The entrance hole occupied by the stub is sealed with a ring grommet and the unoccupied entrance hole by a solid grommet.

The opening in both ends of the unprotected 11- and 16-pair terminal housing affords a practical means of connecting a plastic and lead cable together where direct splicing is not desired.

The cable sheath and the terminal housing are bonded through the binding post block so that the sheath and housing are at the same potential. The cable shield and the terminal housing are bonded together where plastic stubs are furnished.

The binding post blocks with cable stub can be furnished separately for use in inside terminal boxes. A protected binding post block, ground strip and No. 504 protector units can be furnished for inside building installa-



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tion where fuseless station protection is desired.

The overall dimension of the ST-11 housing is 5 inches x 13½ inches x 2¾ inches and the ST-16 housing is 5 inches x 18¾ inches x 2¾ inches. Request NP 307.

• • •

AUTOMATIC SPLICE AND DEADEND—A new automatic type splice and a new deadend for use with rural distribution telephone cable supporting wire and with .109 conductor and all 12

Wirelink

BWG iron wire also have been developed by the Reliable Electric Co.

They are based on the principle of the Reliable Strandlink and Strandvise and are especially adapted for splicing and deadending the .109 extra high

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POLES

B. J. Carney & Co., 100 N. 7th St., Minneapolis, Minn.—Western red cedar poles. Pentrex Butt Treated or Plain.

Cascade Pole Co., P.O. Box 743, Tacoma, Wash. — Creosoted Douglas Fir and Cedar Poles.

C. M. Christiansen Co.—Northern White Cedar Poles, Pentachlorophenol treated. Plant and Yards, Phelps, Wis.

Dierks Lumber & Coal Company, Wood Preserving Division, 700 Dierks Building, Kansas City, Missouri. Southern Pine select poles, all sizes and lengths, creosote and penta-pressure treated. Prompt shipment.

Eppinger & Russell Co., 80—8th Avenue, New York 11, N. Y.—Creosoted Poles and Cross Arms. Plants: Jacksonville, Fla., Norfolk, Va., Eddington, Pa.

International Creosoting and Construction Co., Galveston, Texas.—Creosoted Southern Yellow Pine Poles. Plants: Beaumont and Texarkana, Texas.

Montana Pole & Treating Plant, Butte, Montana. — PENTA Lodgepole Pine & Western Larch Poles. Pressure or Non-Pressure Treatment.

T. M. Partridge Lumber Co., 731 Lumber Exchange, Minneapolis, Minn. —Northern white and western red cedar poles, creosote and pentachlorophenol treatments.

Texas Creosoting Company—512 Main Street, Orange, Texas—Creosoted Southern Yellow Pine and Douglas Fir Poles. Can also treat with "Penta."

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strength steel messenger supporting five and six pair rural distribution cable.

The Wirelink, for splicing, consists of a heat treated aluminum tube, enclosing case hardened steel gripping chucks, which develop more than nominal strength of the steel supporting wire.

It is pressure packed at factory with petroleum jelly to provide lubrication and to permanently prevent corrosion, making it suitable for splicing conductor, as well as splicing supporting wire.

The Wirevise incorporates the same principle with the added feature of a stainless steel bail. Although one-piece, it is designed to free one leg of the stainless bail to permit easy assembly around insulator spools and through thimble eyes. Request NP 308.

V V

Dow Increases Facilities for Research on Wood

Construction of new, ultra-modern laboratories to house its biochemical research department was begun recently at Midland, Mich., by The Dow Chemical Co.

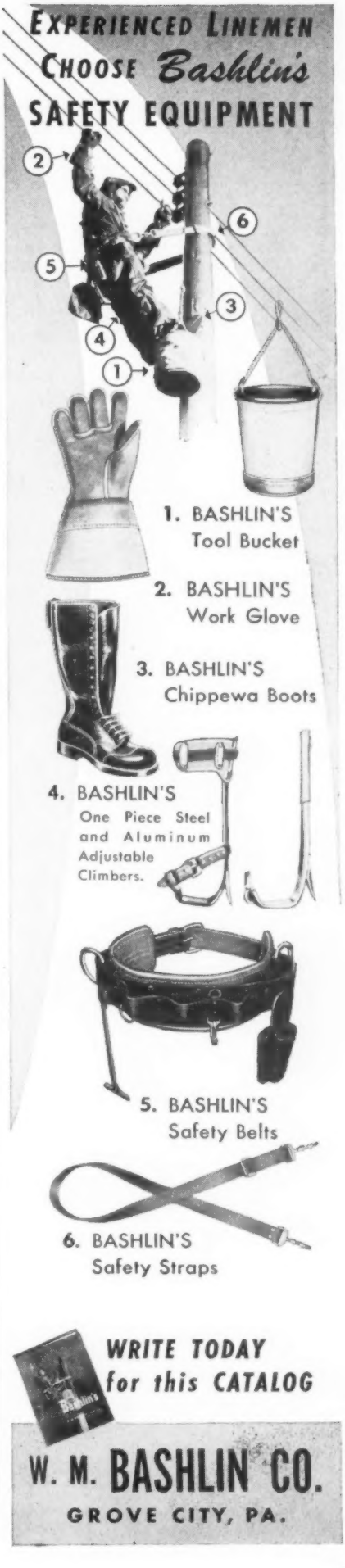
The new structure, 208 by 190 feet, will provide 40,000 square feet of laboratory space for the department's five sections which include toxicology, industrial hygiene, basic biochemical, microbiology and wood laboratories. Completion is expected within a year.

Dow was one of the first chemical manufacturers to establish a toxicological laboratory and to recognize the necessity for adequate toxicological studies in connection with the manufacture, handling and use of chemical products.

Included in the new building are laboratories for research on chemicals used in the treatment of wood. Primary emphasis will be on wood preservation problems involving Dow's pentachlorophenol. In addition to facilities for pure culture studies on wood damaging fungi, pressure cylinders are being constructed to broaden Dow's present efforts in studying techniques for treating utility poles, railroad ties, lumber, and many other items requiring protection from deterioration.

V V

"To think about our whole free enterprise as one vast economics machine is really not so very farfetched because that is the way it works. No single part of it functions all by itself. Every industry, every factory, every machine tool, even one-man business, every newspaper daily or weekly is connected in many ways with all the rest of the economy." — Bay City (Mich.) *Valley Farmer.*



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TELEPHONES recently removed from service. 3-Bar W.E., Kellogg and S. C. Desk stands complete $10.00—5-Bar $11.00. Leich handsets five years old (No. 86) $15.00; also Federal $15.00. 5-Bar wall W.E. Magneto $6.00. Many of the above on hand. We don't need them but you do. Write Box No. 3529, c/o TELEPHONY.

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are not affected by atmospheric conditions. No corrosion or deterioration. Cold flows. A fraction of the weight of metal anchors. Drill hole, then hammer it home. A new line of expansion anchors available soon. Write for information.

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**Magneto Ringer Boxes:
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5 bar-2500 Ohm @ $6.50 ea.
**A.E. type 1-A, desk handset phone, complete, dial blanked for C.B. or Magneto Service @ $6.50 each.
**Federal Telephone, Magneto, 804-A, like new, complete with new cords, latest model Desk Handset, self-contained magneto telephone, easily convertible for Wall use @ $19.50 ea.
**Ankoseal Cable:
6 pr. 19 ga., 11 pr., 22 ga.
16 pr. 22 ga., 26 pr., 22 ga.
Other Sizes in stock
**Cable SPINNERS:
G.M.P. Model B and C
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Fully Reconditioned and Guaranteed Excellent Price
Call TELE-WIRE Collect
All Material in Excellent Condition or New and Fully Guaranteed.
Terms: 1% 10 days, Net 30; FOB N. Y.

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CARRIER EQUIPMENT
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12 Channel East & West Carrier Terminals using Freq. West to East 100 to 148 K C and East to West 36 to 84 K C. Above Equipment is less Signaling, Power supply and 4 Wire Terminal Equipment, otherwise complete and in Excellent Condition (Spare Parts Available). Equipment is Mounted on 11'6" Racks which can be cut down to approx. 9'6" if necessary. Also available 3 LENKURT No. 42-C R 12 Channel Repeaters for use with above having same frequencies—these are complete, less power supply.

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These are designed for telephone service in the 72-76 mc. band, and are ideal for setting up a communication system along a pipeline, railroad, or in mountainous or bush country. Each terminal consists of the following:

1—Link Radio Type 1498T Transmitter
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